C168P User's Manual

Universal 8 Port Serial Board

May 1999 (7th Edition)

The content of this manual is also available in CD-ROM and at Moxa Web Site.

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C168P User's Manual

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The followings are the services we provide.

E-mail for technical support
address: *support@moxa.com.tw*

FTP site for free driver update
address: *ftp.moxa.com*
or
ftp.moxa.com.tw
user ID: *ftp*
password: your_email_address

World Wide Web (WWW) Site for product info
address: *www.moxa.com*
or
www.moxa.com.tw

About This Manual

This manual is composed of six Chapters and one Appendix. This manual is written for installer, system administrator and software programmer.
If you are a first-time installer and system administrator, we recommend you to go through the whole manual except Chapter 4.

If you are a software programmer, you may refer to Chapter 4 “Serial Programming Tools”.

If you need cable wiring information, please see Chapter “Connection Option (Opt8x) and Cable Wiring”.

If you encounter any problem during installation, please refer to Chapter “Troubleshooting”.

Chapter 1 Introduction
Overview and features of the C168P boards, list of items and overall installation guide.

Chapter 2 Hardware Installation
Hardware installation for the C168P boards and connection option (Opt8x) is detailed.

Chapter 3 Software Installation
This Chapter details the software installation, configuration, driver loading/unloading, driver upgrade and removal for various operating systems: Windows NT, Windows 95/98, DOS.

Chapter 4 Serial Programming Tools
This Chapter roughly describes the programming tools for various O.S. platforms, including *PComm* under Windows NT, Windows 95/98 and API-232 under DOS. Also RS-485 programming issue is covered (for Opt8J).

Chapter 5 Connection Option (Opt8x) and Cable Wiring
This Chapter describes the RS-232/422/485 cable wiring for each connection option (Opt8x).

Chapter 6 Troubleshooting
This Chapter describes the problems and possible answers for C168P.

Appendix Technical Reference
Specification details, I/O port address map, and DB62 pinouts are described.

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Introduction

Overview

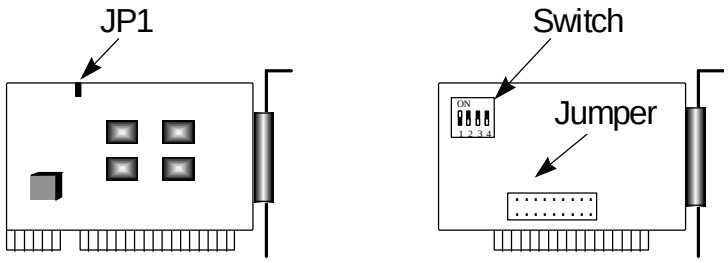
The Standard Multiport Async Solutions

The standard **C168P** multiport boards offer 8 serial ports for connecting terminals, modems, printers, data acquisition equipment and any other serial devices to the PC/AT and its compatible systems.

The Smartio C168P is equipped with **custom-designed ASIC chip** which replaces lots of conventional ICs and reduces the board to half-size. The whole family supports 16 bit architecture. Full range of I/O addresses and IRQs are available. In addition, with **on-board EEPROM** for storing the configuration data, the family is designed without jumper or switch. These features make each port on the board truly independent to any other port and thus compatible with most existing multiport boards.

The C168 board is also available in PCI bus. Please contact MOXA dealer/distributor or MOXA Web site for more details.

Hardware Configuration Method



Smartio Family

Traditional
Multipoort Board

New : set I/O address and IRQ via software Utility.

Traditional : set switch and and jumper manually for I/O address and IRQ.

Instead of using traditional jumper or switch for IRQ and I/O address settings, hardware configuration of each port is easily set by DOS utility, **Io-irq.exe**, which reads and writes the on-board EEPROM for configuration information through the **CAP** (**Configuration Access Port**) **address**. The CAP address is the only channel via which the configuration utility Io-irq.exe can access the board, which is identical to **the first port's base I/O address**.

The only jumper, **JP1**, is designed in case that users forget the CAP address. Normally JP1 is left open. When JP1 is short, the CAP address is forced to a fixed I/O address, **0xA700**. However, to adopt quick installation (described later), it is a must to keep JP1 always short.

Quick Installation

To ease the hardware configuration, users who install **only one C168P board under Windows NT/95/98** are recommended to adopt **quick installation** described in Chapter 2.

Because the family is so flexible in hardware configuration that they are compatible virtually with all kinds of other manufacturer's multiport boards using 16450 or 16550 UART.

Operating System Support

The family is operational under most popular operating systems such as Windows NT, Windows 95/98, SCO UNIX/XENIX/OpenServer, DOS, Linux, QNX, FreeBSD, etc. However, **MOXA device drivers** for Windows NT, Windows 95/98, Linux and DOS are provided for easier installation, configuration and better performance. In this manual, chapters for MOXA **Windows NT**, **Windows 95/98** and **DOS** device drivers are included. For other compatible systems not mentioned, please refer to the respective operating system's manual for how to install and configure the standard driver.

MOXA Serial Comm Tools

For easy application development, MOXA provides an easy-use serial communication library under Windows NT/95/98 (***PComm***) and DOS (**API-232**). Users can use this library to develop your own applications using Microsoft C, Turbo C, Assembly, QuickBASIC, Turbo Pascal, Clipper, Visual Basic, Visual C++, Borland Delphi, etc. **Utilities**, such as diagnostic and monitor, are included for diagnosing the board/port or monitoring the communication status.

Wide Applications

The C168P is suitable for many applications. Here are a few:

- Internet/Intranet Connection
- Remote Access Application
- Multi-user Application
- Industrial Automation
- Office Automation
- Telecommunication
- PC-based (vending) Machine or Kiosk System
- Point-of-Sale (POS) System

Features

- Custom-designed ASIC, compact board size (half-size)
- No switch no jumper, easily configured by software
- Independent I/O address, IRQ setting for each of 8 serial ports
- 16 bit AT bus architecture, more IRQs supported
- Isolation protection for RS-422 (optional connection box Opt8F)
- ***PComm*** serial communication tool
- Support popular OS ¡ WWindows NT, Windows 95/98, DOS, Linux
- Compatible with many other OS ¡ QNX, SCO UNIX/OpenServer, SCO XENIX, Free BSD

	C168H/HS
Windows NT	P
Windows 95/98	P
DOS	P
Linux	R
SCO UNIX/OpenServer	C
QNX	C
SCO XENIX	C
FreeBSD	C

P: Driver supported by Moxa and shipped with product
R : Driver supported by Moxa but sent by request
C : Driver supported by OS
Note: MOXA FTP site is available for driver download

Check List

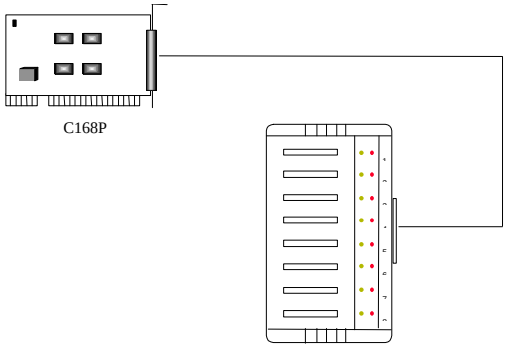
Upon unpacking the C168P package, you should find the following items in the package,

- C168P 8-port serial async board
- Device driver diskettes:
  - Windows NT and Windows 95/98 ¡ ÑÑ
  - DOS ¡ ÑÑ
- C168P User's Manual (This Manual)
- PComm Lite diskette ¡ ÑÑ

You need also one of the following connection options:

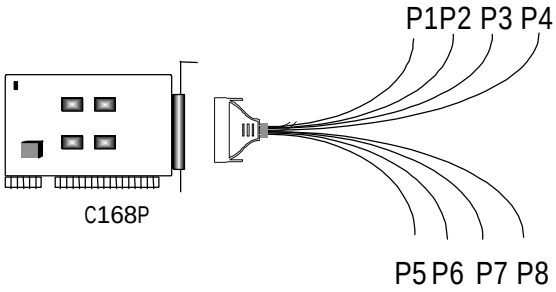
Opt8A/Opt8B/Opt8S

- RS-232 connection box with 8 DB25 female/male/female ports, respectively (surge protection for Opt8S).
- 1.5 meter DB62 to DB62 cable.



Opt8C/Opt8D

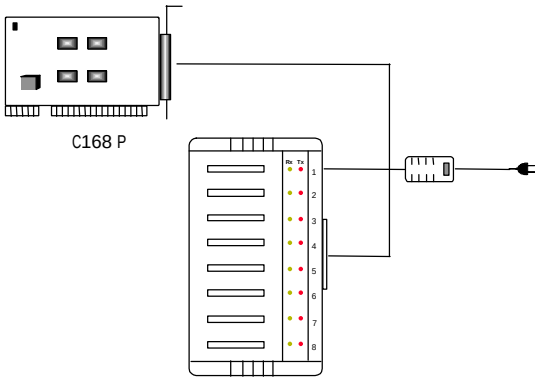
- RS-232 octopus cable with 8 port male connectors, DB25 for Opt8C and DB9 for Opt8D (1 meter long).



Opt8C/Opt8D

Opt8F/Opt8Z

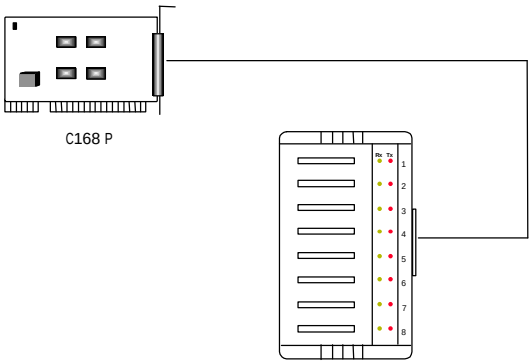
- RS-422 connection box with 8 port female DB25 connectors (isolation protection for Opt8F).
- 1.5 meter DB62 to DB62 cable.
- 110V or 220V adapter.



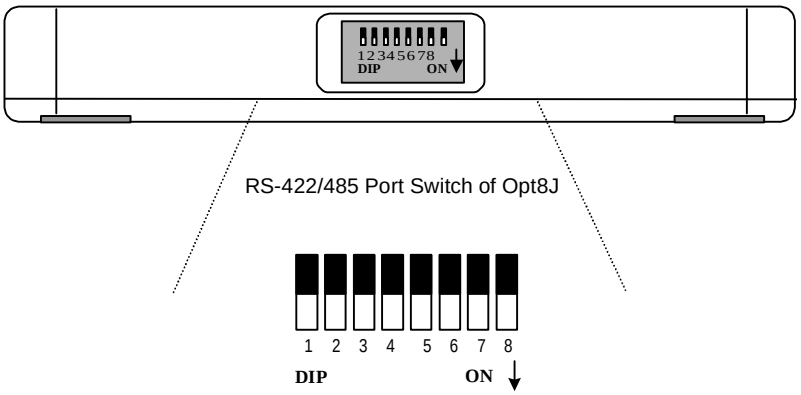
Opt8F/Opt8Z

Opt8J

- RS-422/485 connection box with 8 port female DB25 connectors.
- 1.5 meter DB62 to DB62 cable.
- 110V or 220V adapter.



Opt8J is the RS-422/485 connection box with 8 port female DB25 connectors for MOXA 8 port boards, including the C168P. There are 8-DIP switches on the side of the Opt8J. Each switch controls the communication mode (RS-422 or RS-485) of each port, respectively.



RS-422 Mode

Set the respective switch to **OFF** position to use RS-422 interface. This means the port is always ready to transmit and receive data simultaneously (full-duplex).

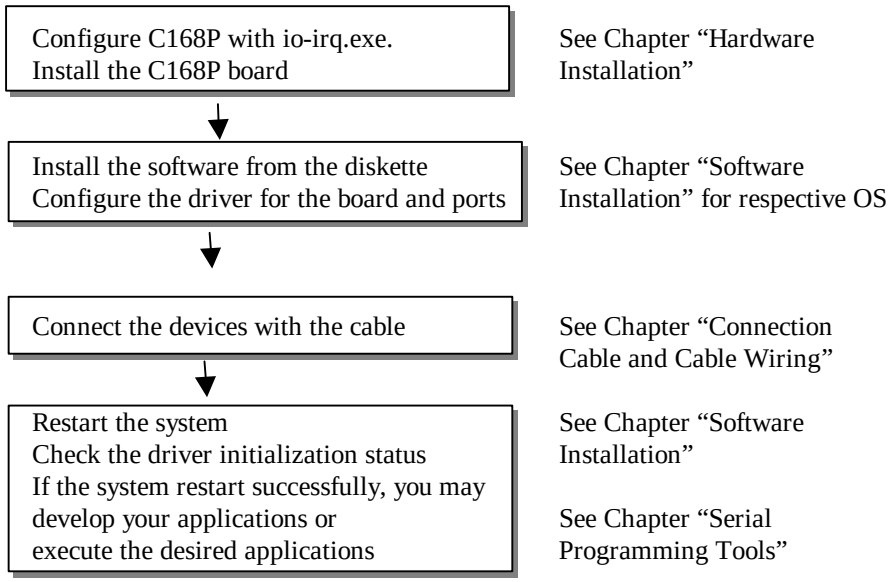
RS-485 Mode

The Opt8J supports only 2-wire RS-485 communication. Set the respective switch to **ON** position to use RS-485 interface. This means the port can transmit data only when RTS is asserted, and receive data only when RTS is not asserted (half-duplex).

Refer to Chapter "Connection Option (Opt8x) and Cable Wiring" for RS-422/RS-485 cable wiring. And also to Chapter "Serial Programming Tools" for Opt8J RS-485 programming details.

Installation Guide

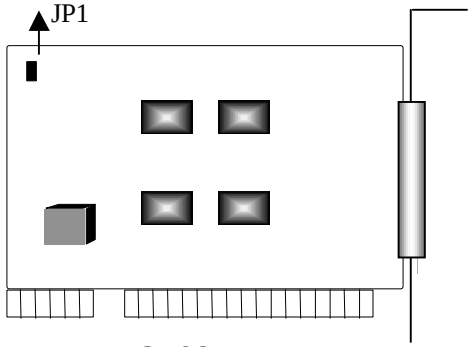
This section gives a brief summary of how to install the C168P under each supported operating system. The installation is simple and involves the following stages:


Configure C168P with io-irq.exe.
Install the C168P board
See Chapter "Hardware Installation"
Install the software from the diskette
Configure the driver for the board and ports
See Chapter "Software Installation" for respective OS
Connect the devices with the cable
See Chapter "Connection Cable and Cable Wiring"
Restart the system
Check the driver initialization status
If the system restart successfully, you may develop your applications or execute the desired applications
See Chapter "Software Installation"
See Chapter "Serial Programming Tools"

2

Hardware Installation

The installation of the C168P consists of hardware and software installation. The hardware installation is detailed in this chapter. The next chapter deals with the software installation for various operating systems.



C168P

Default Settings

The C168P has the following default (factory) settings:

I/O address:	**0x180** (Port 1), **0x188** (Port 2), **0x190** (Port 3), **0x198** (Port 4) **0x1A0** (Port 5), **0x1A8** (Port 6), **0x1B0** (Port 7), **0x1B8** (Port 8)
IRQ:	**10**
INT Vector:	**0x1C0**
CAP Jumper JP1:	**Open**

Note ! **If the default settings above are what you desire and good for the system without conflicts, you may simply install the board in the system and go directly to the next chapter, "Software Installation". Otherwise, follow the instructions below.**

Now you should do either **the normal hardware installation** (detailed in the later section, "Hardware Installation with IO-IRQ Utility") or **the quick hardware installation** (detailed right in the next section, "Quick Hardware Installation"). The latter is provided to facilitate the hardware installation, only under the circumstances that:

- **Only one C168P board** is allowed to install in a system.
- **Windows NT and 95/98** are the only operating systems supported.
- I/O address **0xA700** must be free

Quick Hardware Installation

To fully utilize the superior feature of flexible hardware configuration design of the C168P, a quick and easy method of installation is designed for users, which absolutely free the users from hardware configuration effort, i.e., **installation without running configuration program: Io-irq.exe**. Simply always short the jumper JP1. The software and hardware configuration will be completed at the same time while doing the software configuration.

How to Do Quick Hardware Installation

Users who install **only one C168P board under Windows NT/95/98** are strongly recommended to do the quick installation as follows:

1. **Short the jumper JP1** on the upper-left corner of the board.

2. Plug the board in PC with the desired system installed, which is powered off in advance.

3. Process software installation, detailed in the next chapter.

   This is to specify the desired I/O address, IRQ and INT Vector in the software configuration panel, no matter what hardware settings are on the board. The software configuration program will automatically update the hardware settings. After this, users already complete the whole installation.

4. Shutdown System (Windows NT/95/98).

5. DO power OFF and then ON (or Reset) the PC. (**Please cold start.**)

6. Restart System (Windows NT/95/98).

It is very important to keep the JP1 always short in this case. Without running the hardware configuration program, Io-irq.exe under DOS prompt, the software configuration program will automatically update the hardware settings of the board while updating the software settings. This saves the trouble doing hardware configuration. However, remember to **cold start the system every time the configuration changed.**

Hardware Installation with IO-IRQ Utility

This section is for those who can not use quick hardware installation:

- Install two or more C168P boards in a system.
- Fail to install, due to the I/O address 0xA700 is not available or has conflict in the system.
- Use operating systems other than Windows NT and 95/98.

Before proceeding the **software installation**, detailed in the next chapter, "Software Installation", do **hardware configuration** to setup the I/O address and IRQ with **"Io-irq.exe"**, detailed in the next section.

Remember to keep the hardware settings in mind for the software installation.

The C168P has the following default (factory) settings:

I/O address :	**0x180** (Port 1), **0x188** (Port 2), **0x190** (Port 3), **0x198** (Port 4)
	0x1A0 (Port 5), **0x1A8** (Port 6), **0x1B0** (Port 7), **0x1B8** (Port 8)
IRQ :	**10**
INT Vector :	**0x1C0**

Because the ASIC-designed C168P has no switch and no jumper for configuring manually the I/O address, IRQ, INT vector, etc. of the boards, you **must** run the software utility, **Io-irq.exe**, in the driver diskette under **DOS** system to change the hardware configuration.

1. Choose a PC that has **DOS** system inside.

2. Power off the PC.

3. Make sure no hardware conflict and plug the board in a free 16-bit slot of the PC, **one board at a time with JP1 open**.

> H If you are installing multiple boards, insert one board at a time and configure it using the Io-irq program before inserting the next board. This is to prevent conflict between two boards with same default hardware settings.
> The C168P has the following default (factory) settings,
> I/O address: **0x180** (Port 1), **0x188** (Port 2), **0x190** (Port 3), **0x198** (Port 4)
> **0x1A0** (Port 5), **0x1A8** (Port 6), **0x1B0** (Port 7), **0x1B8** (Port 8)
> IRQ: **10**
> INT Vector: **0x1C0**
> Configuration Access Port (CAP): **0x180**

4. Power on the PC and enter into **DOS** system.

5. Run the utility "**Io-irq.exe**" contained in the driver diskette to set up I/O address, IRQ and INT vector of the board. Please refer to the next section, "IO-IRQ Utility and Hardware Configuration" for more details. Or follow the on-line help to configure the C168P board.

   After completing the hardware configuration, the board is ready for use under operating systems, such as Windows NT and 95/98, DOS etc.

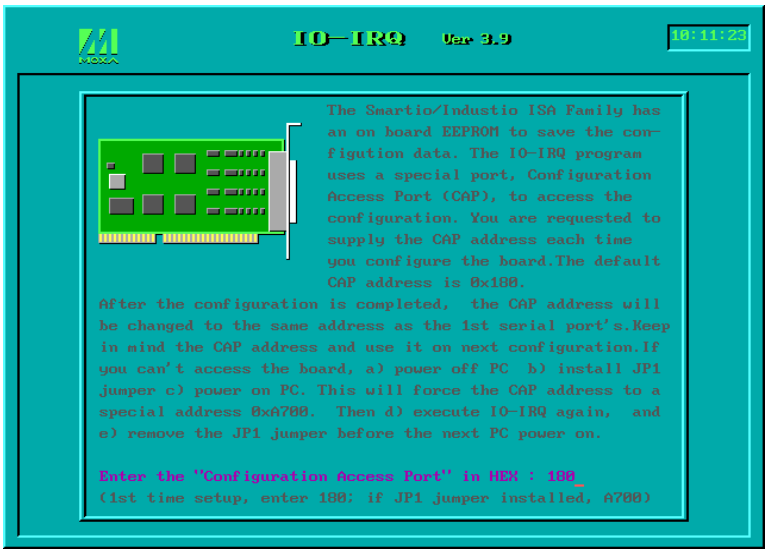
IO-IRQ Utility and Hardware Configuration

Note that the CAP address, e.g. 0x180, is identical to **the first port's I/O address** except in one case that the JP1 jumper is installed before powering on the PC. In this case, the CAP address will be forced to **0xA700**. The CAP address must be typed correctly. With the correct CAP address, the utility can find the configuration stored in the **on-board EEPROM** and display it on the configuration panel. The CAP address is the only channel via which the configuration utility Io-irq.exe can access the board.

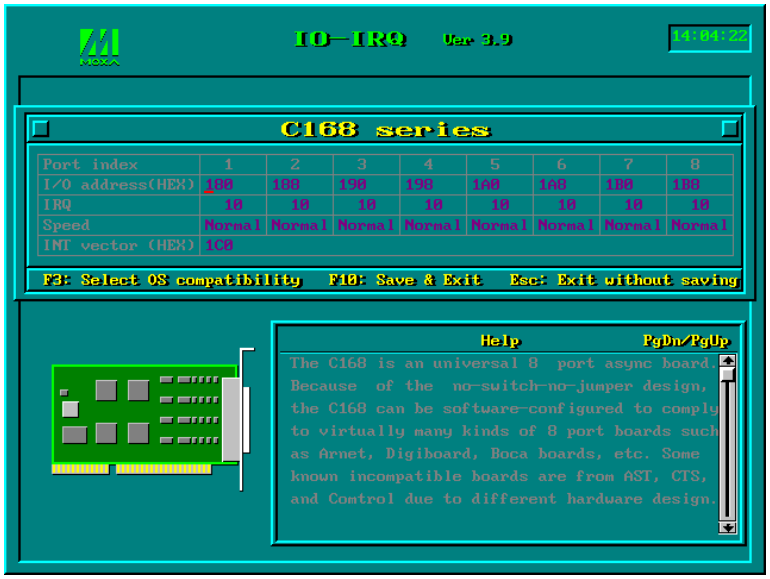
1. Run the utility "**Io-irq.exe**" contained in the driver diskette to set up I/O address, IRQ and INT vector of the board.

IO-IRQ Ver 3.9
10:10:07
IO-IRQ is the 1st step to configure the I/O address, IRQ, etc of the no-switch/jumper Smartio/Industio ISA Family and C360 boards.
Be sure that one (and only one) board has already been installed in the system before running this program. If more than one board need to be configured, configure one board at a time.
What is the board type :
Smartio/Industio ISA Family
C360 SuperPort Board

2. Select "Smartio/Industio ISA Family" and press ENTER key.


IO-IRQ Ver 3.9
10:11:23
The Smartio/Industio ISA Family has an on board EEPROM to save the configution data. The IO-IRQ program uses a special port, Configuration Access Port (CAP), to access the configuration. You are requested to supply the CAP address each time you configure the board.The default CAP address is 0x180.
After the configuration is completed, the CAP address will be changed to the same address as the 1st serial port's.Keep in mind the CAP address and use it on next configuration.If you can't access the board, a) power off PC b) install JP1 jumper c) power on PC. This will force the CAP address to a special address 0xA700. Then d) execute IO-IRQ again, and e) remove the JP1 jumper before the next PC power on.
Enter the "Configuration Access Port" in HEX : 180
(1st time setup, enter 180; if JP1 jumper installed, A700)

3. Enter the CAP address of the C168P board to be configured.


IO-IRQ Ver 3.9
14:04:22
C168 series
Port index 1 2 3 4 5 6 7 8
I/O address(HEX) 180 190 190 190 1A0 1A0 1B0 1B0
IRQ 10 10 10 10 10 10 10 10
Speed Normal Normal Normal Normal Normal Normal Normal Normal
INT vector (HEX) 1C0
F3: Select OS compatibility F10: Save & Exit Esc: Exit without saving
Help PgDn/PgUp
The C168 is an universal 8 port async board. Because of the no-switch-no-jumper design, the C168 can be software-configured to comply to virtually many kinds of 8 port boards such as Arnet, Digiboard, Boca boards, etc. Some known incompatible boards are from AST, CTS, and Comtrol due to different hardware design.

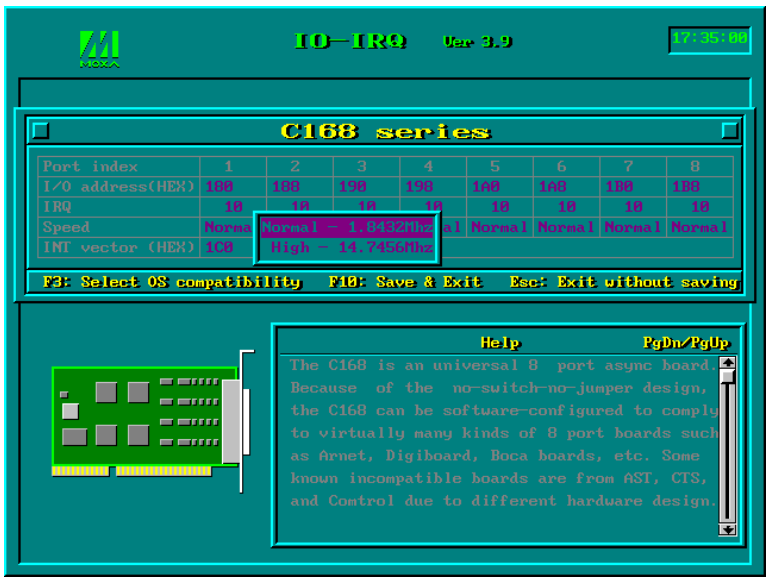
4. Configure the following parameters as necessary.

Port Index Indicate the port index for each port.

I/O address Enter the base I/O address for each port, either sequentially or not. Avoid to conflicting with any other devices.

IRQ Enter the IRQ, 2, 3, 4, 5, 7, 10, 11, 12 or 15, for each port, independently or not.

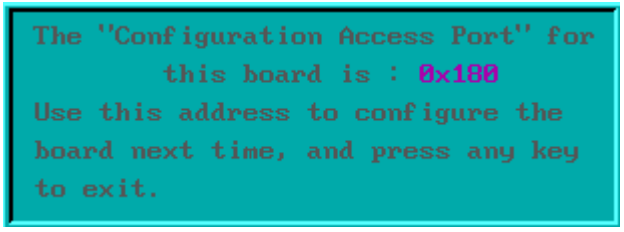
Speed This field specifies the use of **normal or high speed** capability. Normal speed ranges from 50 bps to 115.2 Kbps. High speed ranges from 50 bps to 921.6 Kbps. C168P support only normal speed spectrum. In other word, it is not available for speed faster than 115.2K bps.


IO-IRQ Ver 3.9
17:35:00
C168 series
Port index 1 2 3 4 5 6 7 8
I/O address(HEX) 180 180 190 190 1A0 1A0 1B0 1B0
IRQ 10 10 10 10 10 10 10 10
Speed Normal Normal - 1.8432Mhz Normal Normal Normal Normal
INT vector (HEX) 1C0 High - 14.7456Mhz
F3: Select OS compatibility F10: Save & Exit Esc: Exit without saving
Help PgDn/PgUp
The C168 is an universal 8 port async board. Because of the no-switch-no-jumper design, the C168 can be software-configured to comply to virtually many kinds of 8 port boards such as Arnet, Digiboard, Boca boards, etc. Some known incompatible boards are from AST, CTS, and Comtrol due to different hardware design.

INT Vector Enter the interrupt vector I/O address for all ports. I/O address for interrupt vector is from 00000H to 0FFFFH. Interrupt vector is one byte of I/O address, in which each bit is used to indicate the occurrence of interrupt for corresponding port. To use interrupt vector, type in the hardware Interrupt vector I/O address. If not using interrupt vector, type 0 or leave blank as the interrupt vector.

There are two modes for the C168P driver. One is using interrupt vector, the other is not using interrupt vector. Driver employing interrupt vector scheme is supposed to have better performance than employing polling scheme.

5. Press **F10** to save the configuration and exit the utility.


The "Configuration Access Port" for this board is : 0x180
Use this address to configure the board next time, and press any key to exit.

3

Software Installation

In this chapter, the software driver installation, configuration and driver update/removal procedures are described for various operating systems, including Windows NT, Windows 95/98 and DOS. Before proceeding with the software installation, complete the hardware installation, detailed in previous chapter, “Hardware Installation”.

If it is necessary for you to develop your own applications, please also refer to the next chapter, “Serial Programming Tools”, for programming issues.

Windows NT

Windows NT supports up to **256** serial ports, from **COM1** to **COM256**. To fully integrate the advanced features of Windows NT, multi-process and multi-thread, pure 32-bit Windows NT device drivers are developed for the C168P multiport boards. The driver conforms to Win32 COMM API standard.

- To install the driver for the first time, please go directly to the next section, “Installing Driver”.
- If you already have installed the driver and want to re-configure the board and port, add more boards or delete boards, please refer to the section, “Configuring Board and Port”.
- To update or remove the driver, please go to the section, “Updating Driver” or “Removing Driver”.

Installing Driver

Following is the procedure for installing the C168P driver **for the first time** under Windows NT 4.0.

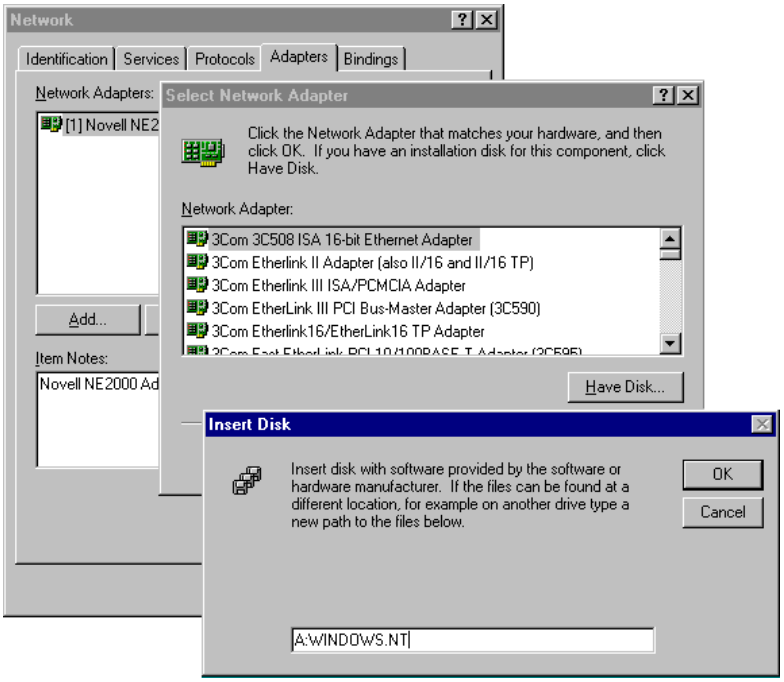
> **Note !** *Make sure the board(s) has(have) already been plugged in the system slot(s) if you are doing **quick** installation.*

1. Please log in NT as **Administrator**.

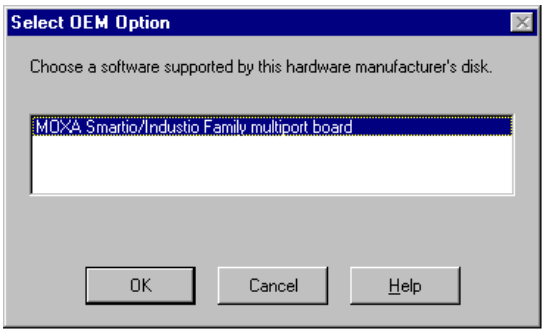
2. Open the [**Control Panel**], click on the [**Network**] icon and select the [**Adapters**] tab.

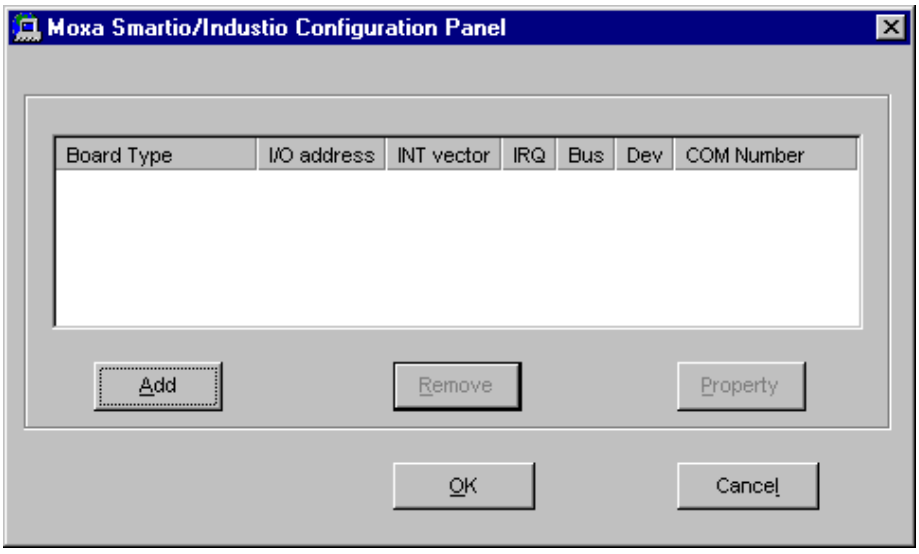
3. Click on the [**Add**] button, then the [**Have Disk...**] button in "Select Network Adapter".

4. Specify the exact path of the driver diskette, **A:\WINDOWS.NT**. Then click [**OK**].

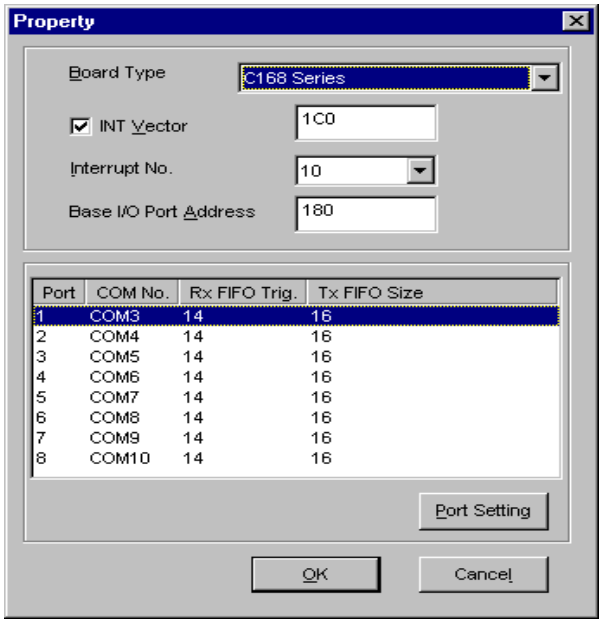

Network
Identification
Services
Protocols
Adapters
Bindings
Network Adapters:
[1] Novell NE2
Add...
Item Notes:
Novell NE2000 Ad
Select Network Adapter
Click the Network Adapter that matches your hardware, and then click OK. If you have an installation disk for this component, click Have Disk.
Network Adapter:
3Com 3C508 ISA 16-bit Ethernet Adapter
3Com Etherlink II Adapter (also II/16 and II/16 TP)
3Com Etherlink III ISA/PCMCIA Adapter
3Com EtherLink III PCI Bus-Master Adapter (3C590)
3Com Etherlink16/EtherLink16 TP Adapter
Have Disk...
Insert Disk
Insert disk with software provided by the software or hardware manufacturer. If the files can be found at a different location, for example on another drive type a new path to the files below.
OK
Cancel
A:\WINDOWS.NT

5. Select "**MOXA Smartio/Industio Family multiport board**" in the "Select OEM Option" dialog box, and then click [**OK**] to enter the "**Moxa Smartio/Industio Configuration Panel**" dialog box to start the installation.



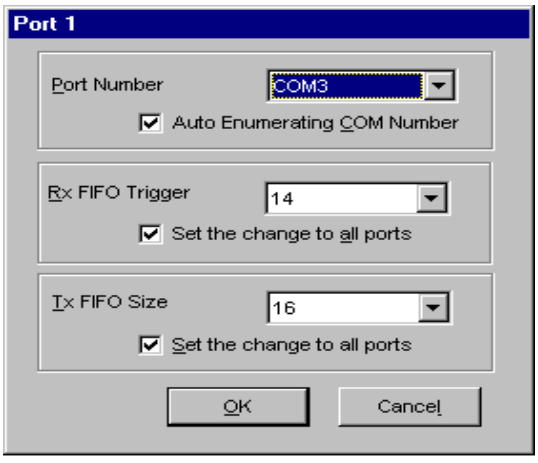


6. In the **"Moxa Smartio/Industio Configuration Panel"** dialog box, click [**Add**] to enter "**Property**" dialog box to add the C168P board. Select the "**C168 Series**" in the "Board Type" field. If necessary, type the desired interrupt vector address, in the "INT Vector" field. Select the desired interrupt number in the "Interrupt No." field. Type the desired base I/O address, in the "Base I/O Port Address" field. All the settings should match settings that are physically set on the board and conflict with no other devices.



Note ! You may go directly to the **step 8** if you need not change any setting.

7. In the "**Property**" dialog box, select the desired port in the port list and click [**Port Setting**] to enter the individual "**Port #**" setting dialog box to change the port COM number mappings or FIFO settings.



- **Port Number**

  You have to set up all the ports of the board with the desired "**COM number**", which should not conflict with other COM number in use. In this "Individual Port Setting" dialog box, you may have two ways to map the physical ports to COM numbers depending on the check box "**Auto Enumerating COM number**".

  If "Auto Enumerating COM Number" is checked and specify the COM number of the first port, subsequent ports are mapped to continuous COM numbers. For instance, if first port is mapped to COM3, then second port is mapped to COM4 sequentially.

  If "Auto Enumerating COM Number" is not checked, specify the COM number for individual port. For instance, the second port can be out of sequence, say COM10, while the first port is mapped to COM3.

- **Rx FIFO Trigger**

  Rx FIFO trigger levels, at 1, 4, 8 or 14 bytes, are available, and the default value is 14 bytes.

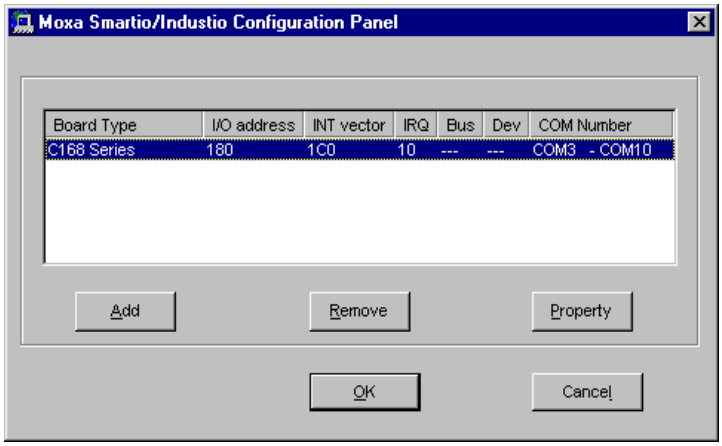
- **Tx FIFO Size**

  Tx FIFO sizes from 1 to 16 bytes are available, and the default value is 16 bytes.

8. Click [**OK**] in the "Port #" and the "Property" dialog boxes to go back to the "Moxa Smartio/Industio Configuration Panel" dialog box.

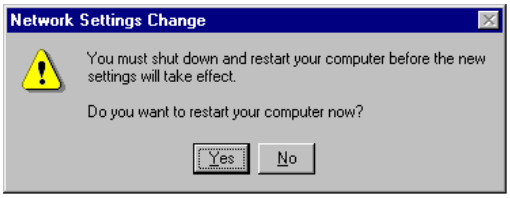
> **Note !** If you need to install more than one board, click [**Add**] and repeat steps **6** to **8** to configure another board. Up to four C168P boards can be installed in a system.

Click [**OK**] to finish the configuration.



9. When configuration is done, click on [**OK**] button in the "Network Settings" dialog box.

10. Restart Windows NT system. The latest configuration will not take effect unless the system restarts.


Network Settings Change
You must shut down and restart your computer before the new settings will take effect.
Do you want to restart your computer now?
Yes
No

> **Note !** The latest configuration will not take effect unless the system restarts.

11. Once the system restarts, you may check the event log issued by the MOXA driver to see if the ports of the board are initialized successfully.

a. Enter the [**Administrative**] group, click on the [**Event Viewer**] icon and select [**System Event Log**] to check a message similar to **"MOXA Smartio C168 Series, with first serial port COM3, has been enabled"** for each configured board.

a. If an error message similar to **"Cannot find any configured MOXA Smartio C168 Series board!"** appears, refer to the "Troubleshooting" chapter for solutions.

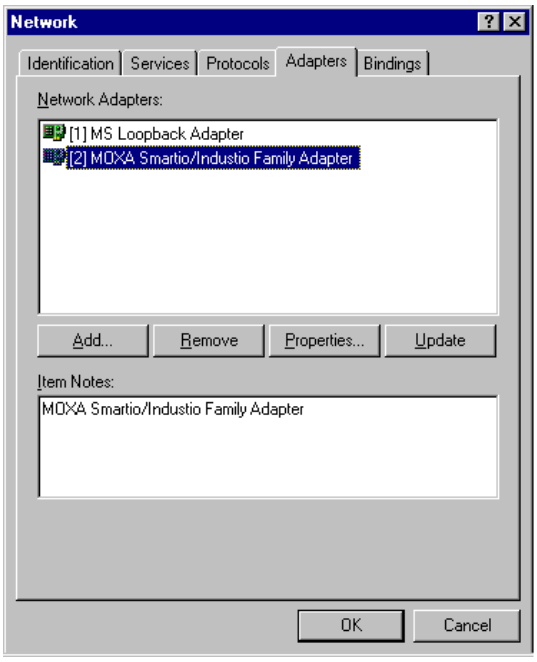
Note ! Once the board and the driver are installed and the driver restarts successfully, you can start to develop applications with the ***PComm*** library (See "Serial Programming Tools" chapter) or the Microsoft Win32 API. You can also execute any ready-made applications, such as ***PComm*** utility Terminal emulator (See "Serial Programming Tools" chapter) or HyperTerminal to transmit/receive data, as well as Remote Access Service to provide dial-up networking capabilities.

Configuring Board and Port

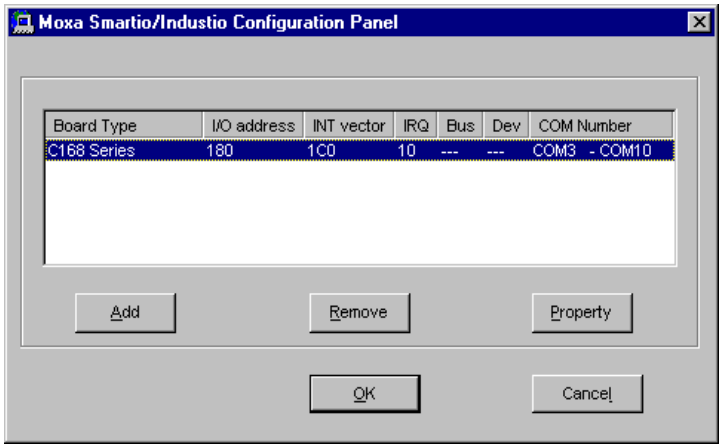
If you already have installed the driver and want to re-configure the ports, please follow this procedure.

1. In the [**Control Panel**], click on the [**Network**] icon and select the [**Adapters**] tab.

2. Select **"MOXA Smartio/Industio Family Adapter"** in "Network Adapters".



3. Click on the [**Property**] button to open the **"Moxa Smartio/Industio Configuration Panel"** dialog box. Please see steps 6-10 in the previous section, "Installing Driver", for more details.



In this configuration panel, you may:

- Click [**Property**] to enter "Property" dialog box to configure the selected board with the correct "COM Number", "INT Vector", "Interrupt no" and "Base I/O Port Address". Please see **steps 6 to 8** in the previous section, "Installing Driver", for more details, except that the "Board Type" field is not supposed to be changed.

- Click [**Add**] to add one more board that is not yet configured in the system. Please see **steps 6 to 8** in the previous section, "Installing Driver", for more details.

- Click [**Remove**] to remove the board currently selected from the configured board list.

- Click [**OK**] to confirm the configuration changes you made.

- Click [**Cancel**] to leave the dialog with the configuration unchanged.

Updating Driver

To update the driver for the C168P boards, simply remove the driver, as described in the next section, and reinstall it as detailed in section, **"Installing Driver"**.

Removing Driver

To remove the driver for the C168P boards,

1. Open the [**Control Panel**], click on the [**Network**] icon, and select the [**Adapters**] tab.
2. Select **"MOXA Smartio/Industio Family Adapter"** in the adapter list, then click on the [**Remove**] button and the [**OK**] button to remove the driver.
3. Restart the system to activate the new configuration.

Windows 95/98

Windows 95/98 supports up to **128** serial ports, from **COM1** to **COM128**. To fully integrate the advanced features of Windows 95/98, multi-process and multi-thread, pure 32-bit Windows 95/98 virtual device port drivers (VxD) compliant with communication drivers (VCOMM) are developed for the C168P and other MOXA multiport boards. The drivers conform to the Win32 COMM API standard.

- To install the driver for the first time driver, please go directly to the section, "Installing Driver".
- If you already have installed the driver and want to re-configure the board and port, add more boards or delete boards, please refer to the section, "Configuring Board and Port".
- To update or remove driver, please go to the sections, "Updating Driver" and "Removing Driver".

Installing Driver

Up to four C168P boards can be installed together as long as the I/O addresses and IRQ number resources are sufficient and available in a system.

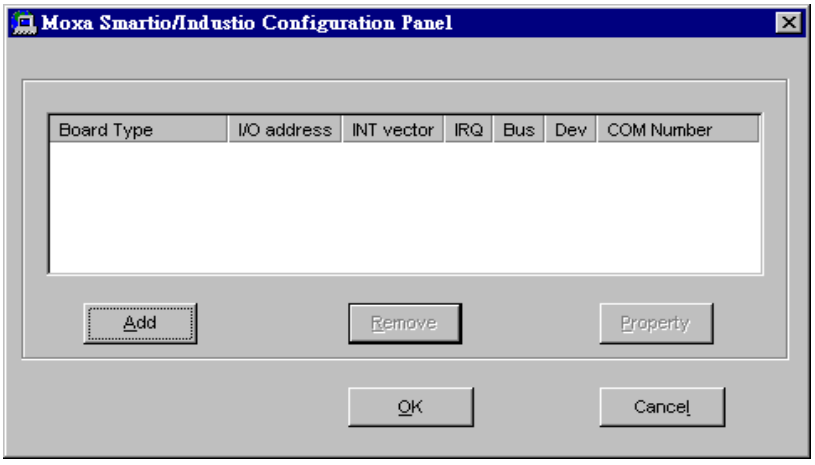
The following is the procedure for installing C168P **for the first time** under Windows 95/98:

1. Run **Setup95.exe** in the driver diskette.

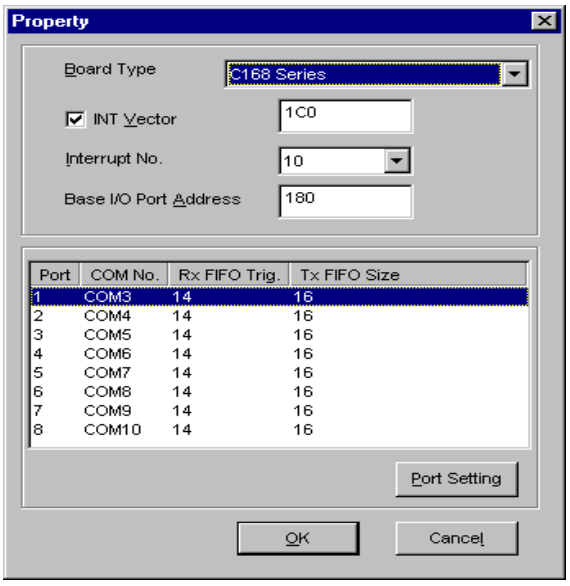
2. Click on [**Next>**] button in the "Welcome ..." message dialog box. And then click on [**Next>**] button in the "Ready ..." message dialog.

3. Click on [**Finish**] button in the "Complete ..." message dialog to enter the configuration panel.

4. The **"Moxa Smartio/Industio Configuration Panel"** dialog will pop up for you to configure the boards and ports.

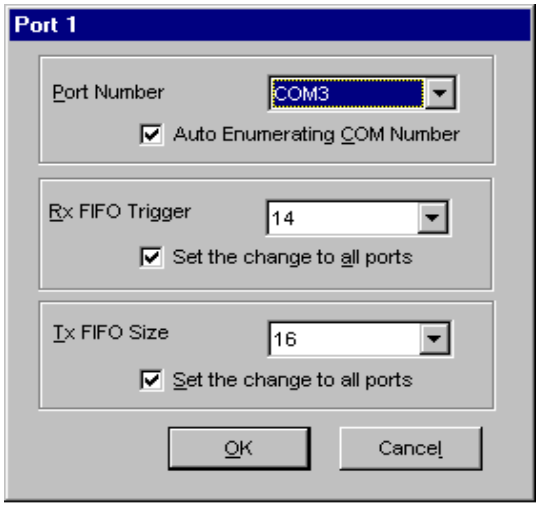


5. In the "**Moxa Smartio/Industio Configuration Panel**" dialog box, click [**Add**] to enter "**Property**" dialog box to add the C168P board. Select the **"C168 Series"** in the "Board Type" field. If necessary, type the desired interrupt vector address, in the "INT Vector" field. Select the desired interrupt number in the "Interrupt No." field. Type the desired base I/O address, in the "Base I/O Port Address" field. All the settings should match settings that are physically set on the board and conflict with no other devices.



Note ! Go directly to the **step 7** if you need not change any setting.

6. In the "**Property**" dialog box, select the desired port in the port list and click [**Port Setting**] to enter the individual "**Port #**" setting dialog box to change the port COM number mappings or FIFO settings.



- **Port Number**

  You have to set up all the ports of the board with the desired "**COM number**", which should not conflict with other COM number in use. In this "Individual Port Setting" dialog box, you may have two ways to map the physical ports to COM numbers depending on the check box "**Auto Enumerating COM number**".

  If "Auto Enumerating COM Number" is checked and specify the COM number of the first port, subsequent ports are mapped to continuous COM numbers. For instance, if first port is mapped to COM3, then second port is mapped to COM4 sequentially.

  If "Auto Enumerating COM Number" is not checked, specify the COM number for individual port. For instance, the second port can be out of sequence, say COM10, while the first port is mapped to COM3.

- **Rx FIFO Trigger**

  Rx FIFO trigger levels, at 1, 4, 8 or 14 bytes, are available, and the default value is 14 bytes.

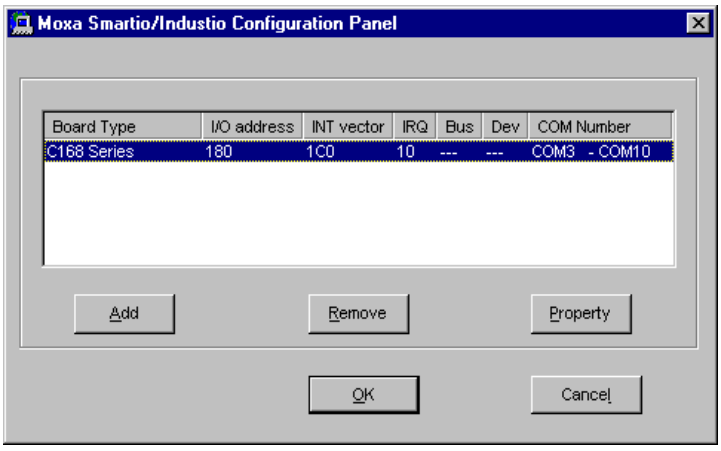
- **Tx FIFO Size**

  Tx FIFO sizes from 1 to 16 bytes are available, and the default value is 16 bytes.

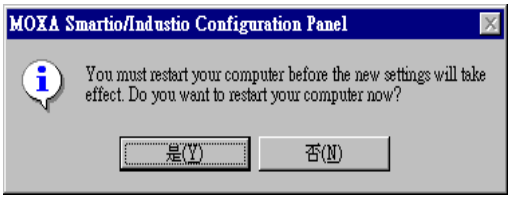
7. Click [**OK**] in the "Port #" and the "Property" dialog boxes to go back to the "Moxa Smartio/Industio Configuration Panel" dialog box.

> **Note !** If you need to install more than one board, click [**Add**] and repeat steps **5** to **7** to configure another board. Up to four C168P boards can be installed in a system.

Click [**OK**] to finish the configuration.



8. Restart Windows 95/98 system**.**


MOXA Smartio/Industio Configuration Panel
You must restart your computer before the new settings will take effect. Do you want to restart your computer now?
是(Y)
否(N)

> **Note !** The latest configuration will not take effect unless the system restarts.

9. When system restarts, all the error conditions of the board will be popped up onto the screen if any. Otherwise, everything should be fine.

If error message like "**Smartio C168 Series (CAP=0x0180, port 1=COM3): Board is not found**" appears, refer to chapter, "Troubleshooting", for solutions.

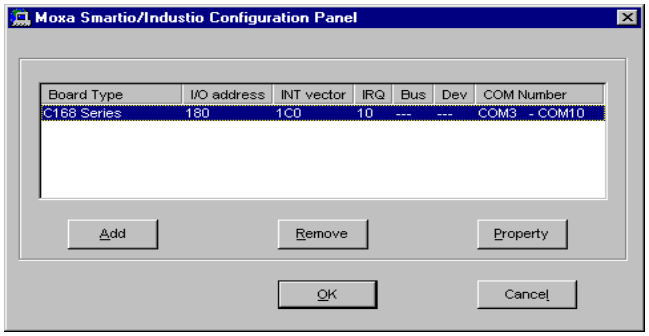
> **Note !** Once the board and the driver are installed and the driver restarts successfully, you can start to develop applications with the ***PComm*** library (See "Serial Programming Tools" chapter) or the Microsoft Win32 API. You can also execute any ready-made applications, such as ***PComm*** utility Terminal emulator (See "Serial Programming Tools" chapter) or HyperTerminal to transmit/receive data, as well as Remote Access Service to provide dial-up networking capabilities.

Configuring Board and Port

If you already have installed the driver and want to re-configure the C168P board and ports, add more boards or delete boards under Windows 95/98, the following is the procedure for you.

1. Click on the Taskbar [**Start**] button, then select [**Programs**] menu, then [**MOXA Utilities**] menu and then [**Moxa Smartio/Industio Configuration Panel**] icon.

2. The Smartio/Industio configuration panel will be popped up. Please see steps 5-7 in the previous Section "Installing Driver" for more details.

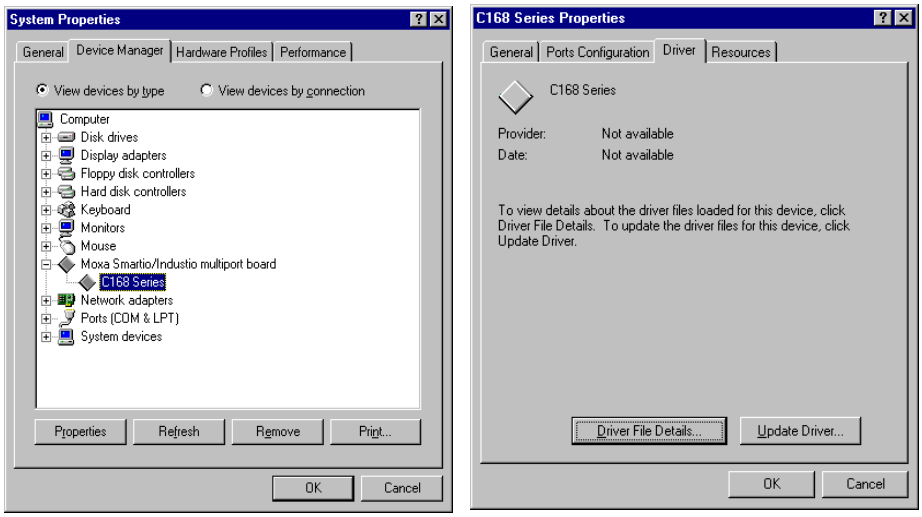


In this configuration panel, you may:

- Click [**Property**] to enter "Property" dialog box to configure the selected board with the correct "COM Number", "INT Vector", "Interrupt no" and "Base I/O Port Address". Please see **steps 5 to 7** in the previous section, "Installing Driver", for more details, except that the "Board Type" field is not supposed to be changed.
- Click [**Add**] to add one more board that is not yet configured in the system. Please see **steps 5 to 7** in the previous section, "Installing Driver", for more details.
- Click [**Remove**] to remove the board currently selected from the configured board list.
- Click [**OK**] to confirm the configuration changes you made.
- Click [**Cancel**] to leave the dialog with the configuration unchanged.

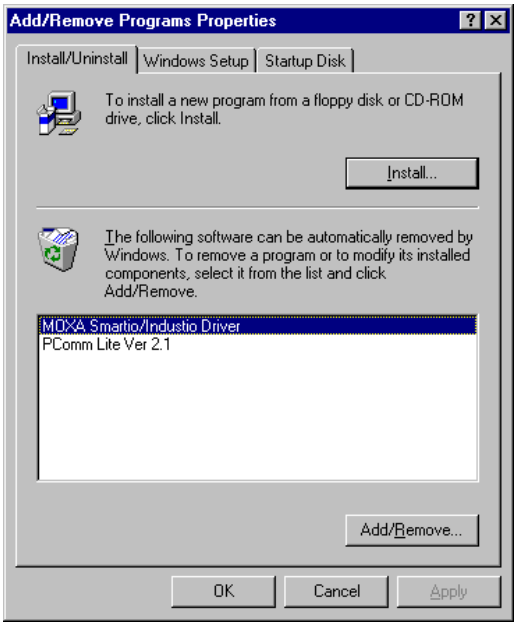
Updating Driver

Open [**Control Panel**] icon, and then [**System**] icon, and then select [**Device Manager**] tab. Then select and open the **"Moxa Smartio/Industio muliport board"** option and then select the "**C168 Series**". Click on [**Properties**] button and then select [**Driver**] tab and then click on [**Update Driver**] button.



Removing Driver

Open [**Control Panel**] icon, and then [**Add/Remove Programs**] icon, and then select [**Install/Uninstall**] tab. Then select and open the **"MOXA Smartio/Industio Driver"** option and then enter [**OK**] to remove the driver.


Add/Remove Programs Properties
Install/Uninstall
Windows Setup
Startup Disk
To install a new program from a floppy disk or CD-ROM drive, click Install.
Install...
The following software can be automatically removed by Windows. To remove a program or to modify its installed components, select it from the list and click Add/Remove.
MOXA Smartio/Industio Driver
PComm Lite Ver 2.1
Add/Remove...
OK
Cancel
Apply

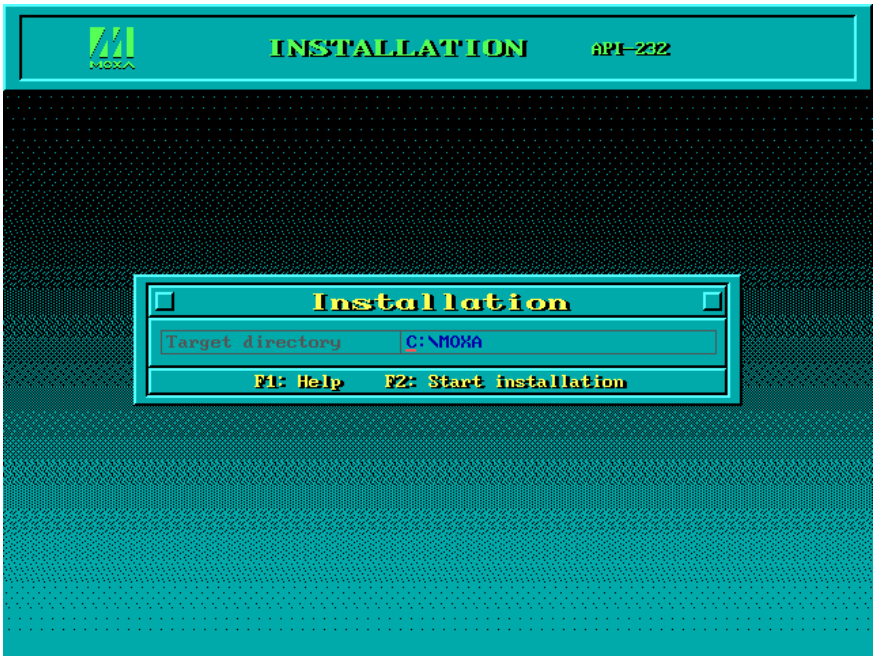
DOS

MOXA DOS API-232 is a software package that assists users to develop and/or debug programs for serial communications. This section will show you how to install the package, how to setup up the driver, and how to load or unload driver.

For details of the serial programming (API-232 Library) and utilities, please refer to the next chapter, “Serial Programming Tools”.

Installing Driver

Run the installation program, **DOSINST.EXE,** in the DOS driver diskette. Specify the target API-232 directory (e.g. **C:\MOXA**) where software driver will be copied. Press **F2** to start the installation.



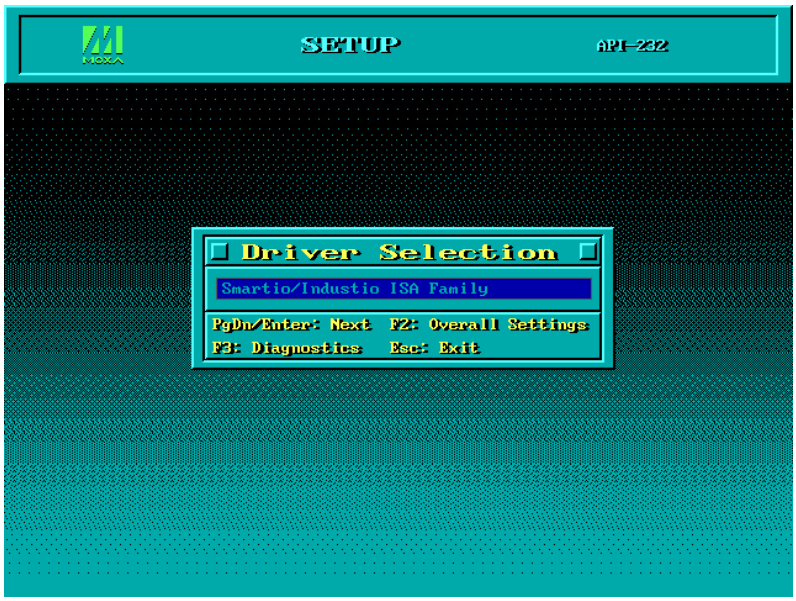
After installation is complete, you will be prompted to proceed running setup program. It is strongly recommended to do so.

INSTALLATION
API-232
Installation complete, 57 files copied.
After leaving this program, you have to run
C:\MOXA\BIN\SETUP.EXE
program to setup board & driver initial values.
Do you want to run SETUP.EXE now ?(Y/N)

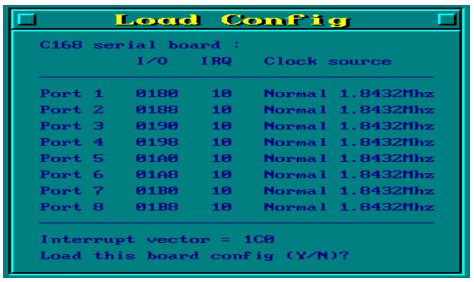
Driver Setup

The following are steps for setting up the C168P driver. Note that it is not intended to illustrate all the convenient functions of the setup programs when configuring the boards. Please refer to the F1 on-line help instructions as running setup program.

1. Run the setup program, **BIN\SETUP.EXE**, in the API-232 directory. Select "**Smartio/Industio ISA Family**" in the "Driver Selection" dialog box.

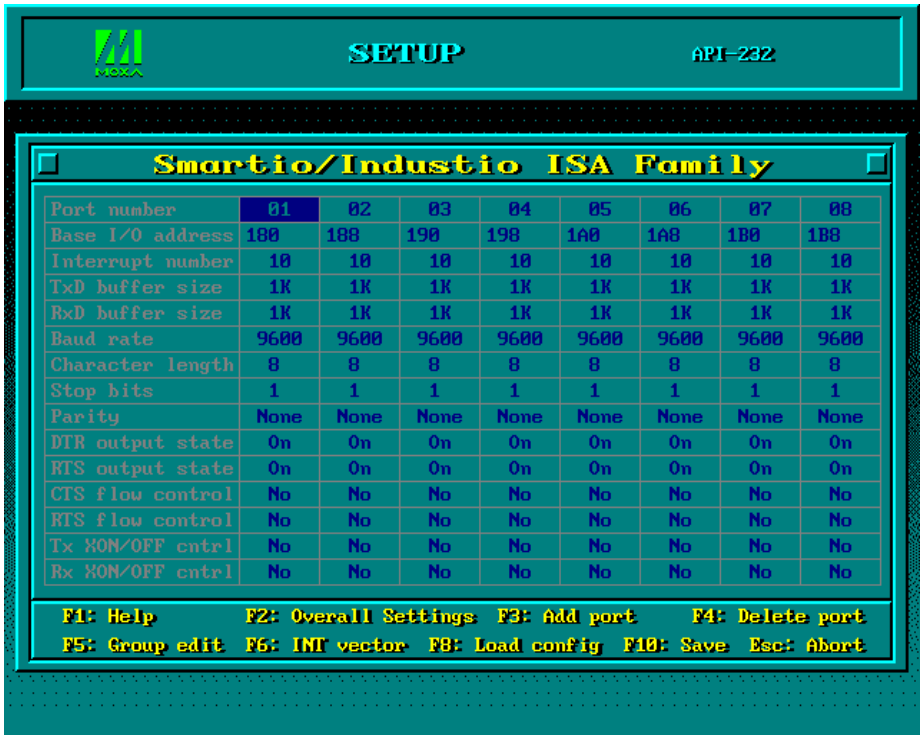


2. Press **Enter** to pop up the SETUP dialog box. In the SETUP dialog box, Press **F8** to specify the **CAP Address** and press **ENTER** and then type **Y** (**YES**) to load the configuration of the board to be setup.


Load Config
C168 serial board :
I/O IRQ Clock source
Port 1 0180 10 Normal 1.8432Mhz
Port 2 0188 10 Normal 1.8432Mhz
Port 3 0190 10 Normal 1.8432Mhz
Port 4 0198 10 Normal 1.8432Mhz
Port 5 01A0 10 Normal 1.8432Mhz
Port 6 01A8 10 Normal 1.8432Mhz
Port 7 01B0 10 Normal 1.8432Mhz
Port 8 01B8 10 Normal 1.8432Mhz
Interrupt vector = 1C0
Load this board config (Y/N)?

3. Now the configuration of the desired C168P board will be shown along with other default settings, such as port number, buffer size, etc.

> **Note !** Up to now you have completed the setup for C168P board. You may skip this step and go directly to the next **step 5** if you need not change any setting or configure any board.


SETUP
API-232
Smartio/Industio ISA Family
Port number 01 02 03 04 05 06 07 08
Base I/O address 180 188 190 198 1A0 1A8 1B0 1B8
Interrupt number 10 10 10 10 10 10 10 10
TxD buffer size 1K 1K 1K 1K 1K 1K 1K 1K
RxD buffer size 1K 1K 1K 1K 1K 1K 1K 1K
Baud rate 9600 9600 9600 9600 9600 9600 9600 9600
Character length 8 8 8 8 8 8 8 8
Stop bits 1 1 1 1 1 1 1 1
Parity None None None None None None None None
DTR output state On On On On On On On On
RTS output state On On On On On On On On
CTS flow control No No No No No No No No
RTS flow control No No No No No No No No
Tx XON/OFF cntrl No No No No No No No No
Rx XON/OFF cntrl No No No No No No No No
F1: Help F2: Overall Settings F3: Add port F4: Delete port
F5: Group edit F6: INT vector F8: Load config F10: Save Esc: Abort

You may now enter/modify each port's configuration. These displayed values are the port initial values as driver is loaded.

Legend:

Some noticeable fields and functions are explained below.

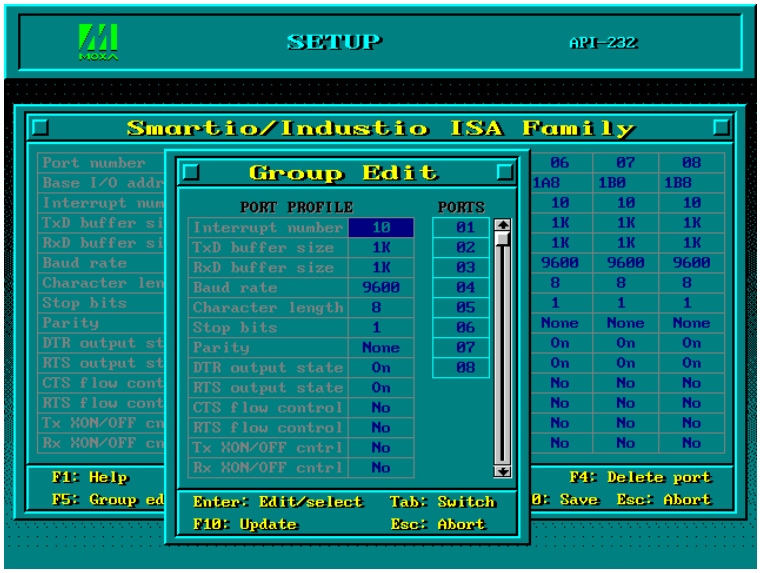
Port number: This is actually the port ID of each port. The application software will refer to the port by its port number (ID). Duplicated port number is not allowed. That is, each MOXA serial port is referred to as port number in terms of serial programming.

You may map the port number range to the one you prefer between 0 and 255 as long as no port number overlapping condition or port number undefined condition occurs. Generally, you should take the convenience of programming into consideration when specifying the port numbers for the board.

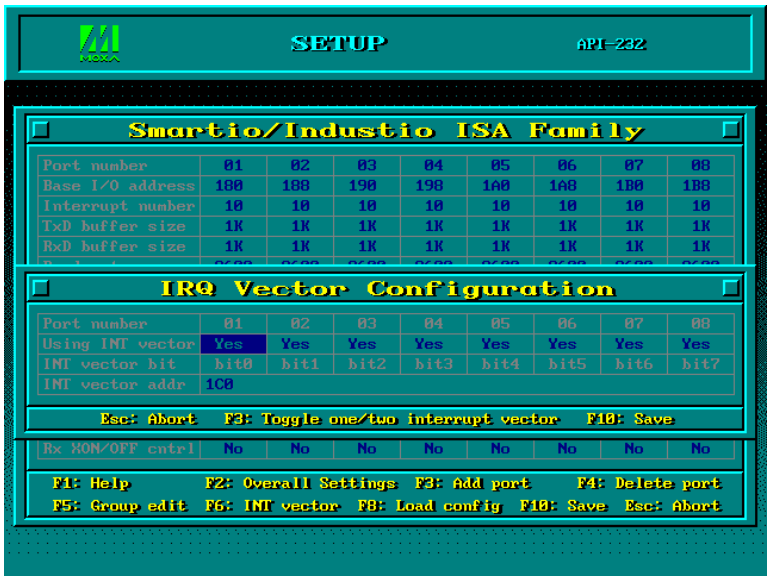
TxD buf size: The transmission (output) buffer allocated in the system for each port.

RxD buf size: The receiving (input) buffer allocated in the system for each port.

F5: Group edit: This is a convenient function that helps you edit the configuration of several ports at one time as a group.



F6: INT vector: This is to set interrupt vector for each port. You can set this feature to "**Yes**" (default) and gain best performance for the board.


SETUP
API-232
Smartio/Industio ISA Family
Port number 01 02 03 04 05 06 07 08
Base I/O address 180 188 190 198 1A0 1A8 1B0 1B8
Interrupt number 10 10 10 10 10 10 10 10
TxD buffer size 1K 1K 1K 1K 1K 1K 1K 1K
RxD buffer size 1K 1K 1K 1K 1K 1K 1K 1K
IRQ Vector Configuration
Port number 01 02 03 04 05 06 07 08
Using INT vector Yes Yes Yes Yes Yes Yes Yes Yes
INT vector bit bit0 bit1 bit2 bit3 bit4 bit5 bit6 bit7
INT vector addr 1C0
Esc: Abort F3: Toggle one/two interrupt vector F10: Save
Rx XON/OFF cntrl No No No No No No No No
F1: Help F2: Overall Settings F3: Add port F4: Delete port
F5: Group edit F6: INT vector F8: Load config F10: Save Esc: Abort

4. Press **F10** to save the latest configuration and exit the SETUP program.

Loading Driver

Having completed the setup, you can load the driver, **"BIN\SER-DRV.EXE"**, at the DOS prompt. The driver will detect the C168P board automatically. If the board is detected, a message similar to below will show:

API-232 Version 3.5
Universal 2/4/8 serial ports Communication Driver
Setup driver …
Device driver setup O.K.

It means the C168P driver is installed properly. At this point, you are ready to execute application that supports API-232 functions, or start developing applications using API-232 library.

If something went wrong, for instance, the board does not match the configuration or the board is missing, the screen will show a message like:

```
API-232 Version 3.5
Universal 2/4/8 serial ports Communication Driver
Setup driver …
None serial port found!!
```

It means the C168P driver is not installed properly. Please refer to chapter, "Troubleshooting", for possible reasons and solutions.

Unloading Driver

To unload (release) the C168P driver from memory, type **"SER-DRV/Q"** at the DOS prompt.

4

Serial Programming Tools

Moxa supports easy but powerful serial programming library and communication troubleshooting utilities under Windows NT, Windows 95/98 and DOS. You will save greatly the developing time, using MOXA Serial Programming Tools.

The following sections will details the installation, the library and the utilities for various platforms.

Windows NT and Windows 95/98

PComm, the professional serial comm tool for PC, is a software package under **Windows NT and Windows 95/98**, which consists of powerful serial communication library for easy programming in most popular languages, useful utilities such as diagnostic, monitor and terminal emulator, illustrative example programs and comprehensive on-line documents.

The serial communication library is useful for developing a system for data communication, remote access, data acquisition or industrial control in the Windows NT and Windows 95/98 environment, which offers an easier solution compared with the more complex Windows Win32 COMM API.

Installation

To install ***PComm***, please run **\Setup.exe** in the diskette. Note that ***PComm*** diagnostic and monitor utilities are for MOXA boards only. MOXA Windows NT or Windows 95/98 device driver as well as MOXA board are required. The driver are installed separately and detailed in Chapter “Software Installation”.

PComm Programming Library

The serial communication library is to assist users to develop programs for serial communications **for any COM port** complying with Microsoft Win32 API. It can ease the implementation of multi-process and multi-thread serial communication programs and hence greatly reduce the developing time.

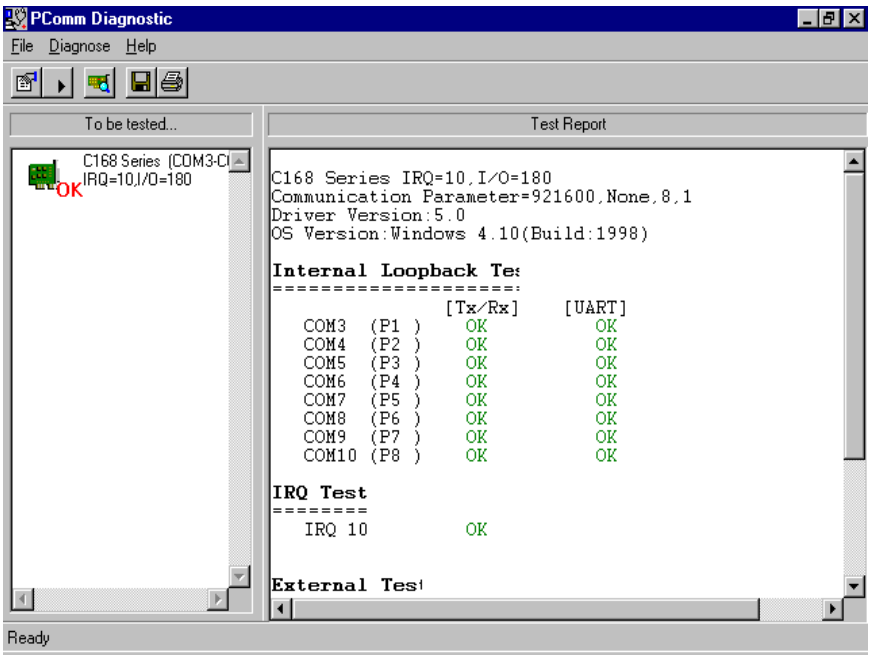
For complete library function description and example programs for Visual C++, Visual Basic and Delphi, please see help file and example programs in ***PComm*** directory for more details.

Utilities

The followings are short descriptions of each utility. For details, please see **on-line help** as running utilities.

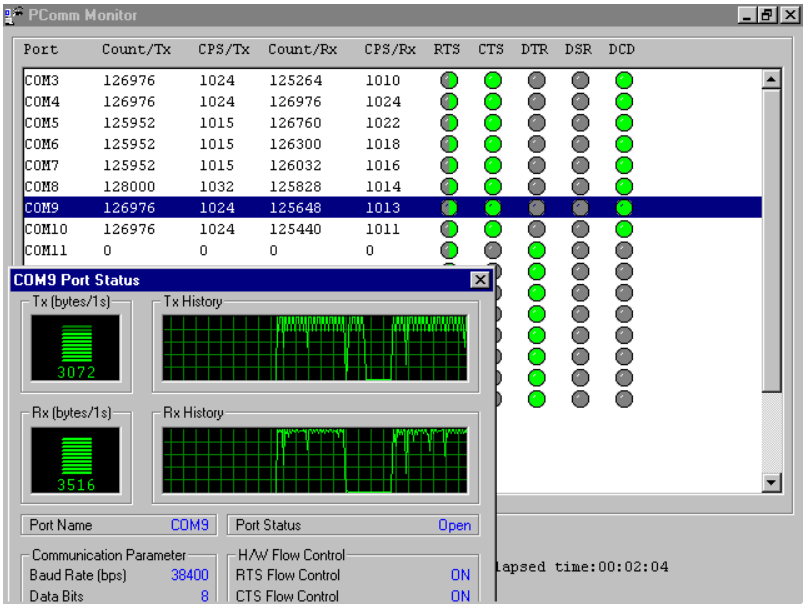
Diagnostic (for MOXA boards only)

A convenient diagnostic program provides internal and external testing, such as IRQ, TxD/RxD, UART, CTS/RTS, DTR/DSR, DTR/DCD testing, etc., for the MOXA boards and ports to verify correct operation of both the software and hardware.



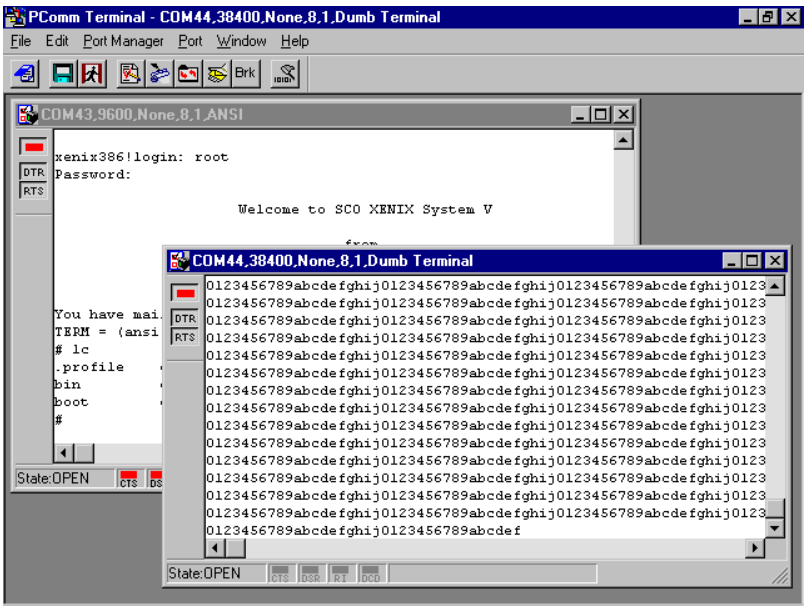
Monitor (for MOXA boards under Windows NT Only)

A useful port status monitoring program allows you to watch the selected MOXA COM ports' data transmitting/receiving throughput and communication line status which are updated and displayed on the screen at every time interval. In addition, you may click on one of the specific displayed port in order to see the current communication parameters and status of that port.



Terminal Emulator

The Terminal Emulator features multi-windows and supports terminal types of VT100 and ANSI. You can transfer data interactively, send pattern periodically or transfer file using ASCII, XMODEM, YMODEM, ZMODEM and KERMIT protocols.



DOS

Installation

API-232 Library is the professional serial programming tool for DOS. It is installed automatically along with the MOXA DOS drivers. The installation is detailed in Chapter “Software Installation”.

DOS API-232 Library

DOS API-232 library supports languages like Microsoft C, Turbo C, Macro Assembly, QuickBasic, Turbo Pascal, Clipper, etc. Sample programs for each supported language are included, and placed in the sub-directory **..\EXAMPLE\% language** of the API-232 directory.

In addition, for DOS C language only, there are also Modem Control and File Transfer library available, supporting Hayes compatible modem control as well as ASCII, KERMIT, XMODEM, YMODEM and ZMODEM file transfer protocol functions.

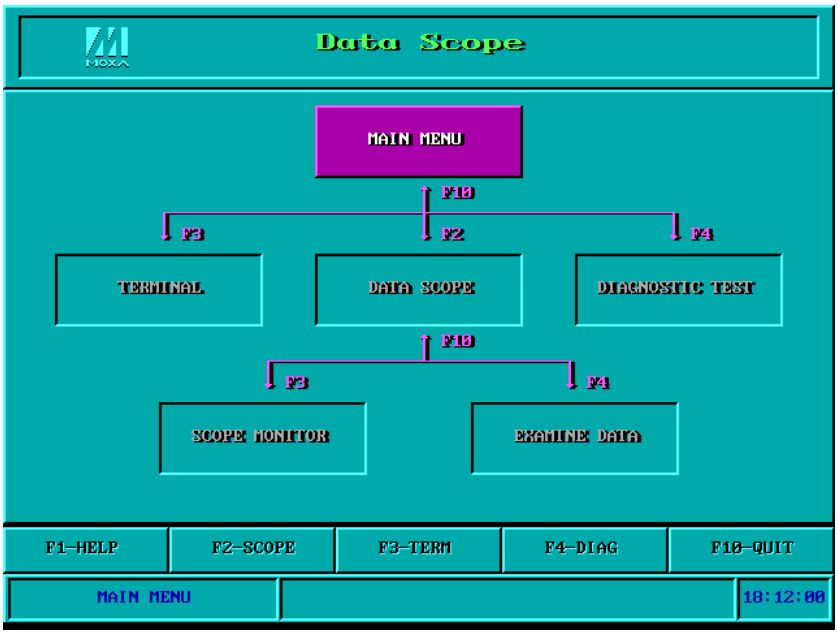
For complete API-232 function description, please see file **API-232.TXT** in the API-232 directory for more details.

Utilities

There are two utilities available for DOS: Data Scope and Diagnose, which are detailed below.

Data Scope

The Data Scope, **BIN\SCOPE.EXE**, is a suite of utility programs that can help users with system troubleshooting and serial communication debugging.



There are three major functions in Data Scope utility:

1. The **Data Scope utility** offers transparent monitoring of serial communication lines and allows data to be streamed to disk storage for later analysis.

2. The **TTY terminal emulation utility** allows user to view the signal status and transfer data interactively or files using ASCII, XMODEM, YMODEM, ZMODEM and KERMIT protocols.

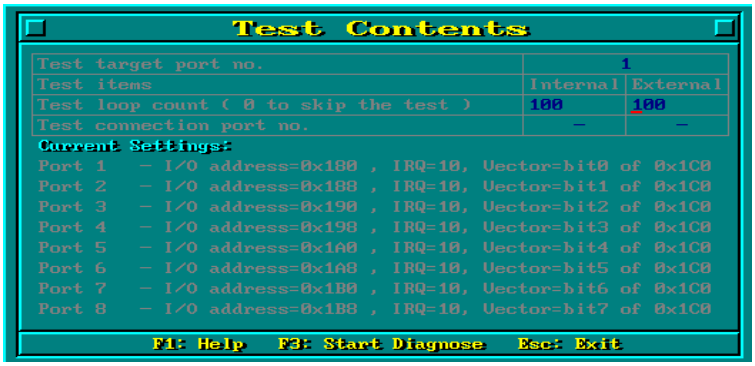
3. The **Diagnostic test utility** provides port connection test with two MOXA ports connected via a properly wired cable.

Please see **on-line help** as running BIN\SCOPE.EXE for more usage and capability information.

Diagnose

The Diagnose, **BIN\DIAGNOSE.EXE**, is a utility that can help users to diagnose the hardware condition of each port of the selected board. See on-line help for more details.

Before executing it, please remove the Moxa driver in advance via executing "SERDRV.EXE/Q" if the Moxa driver is running in the background.


Test Contents
Test target port no. 1
Test items Internal External
Test loop count (0 to skip the test) 100 100
Test connection port no. – –
Current Settings:
Port 1 – I/O address=0x180 , IRQ=10, Vector=bit0 of 0x1C0
Port 2 – I/O address=0x188 , IRQ=10, Vector=bit1 of 0x1C0
Port 3 – I/O address=0x190 , IRQ=10, Vector=bit2 of 0x1C0
Port 4 – I/O address=0x198 , IRQ=10, Vector=bit3 of 0x1C0
Port 5 – I/O address=0x1A0 , IRQ=10, Vector=bit4 of 0x1C0
Port 6 – I/O address=0x1A8 , IRQ=10, Vector=bit5 of 0x1C0
Port 7 – I/O address=0x1B0 , IRQ=10, Vector=bit6 of 0x1C0
Port 8 – I/O address=0x1B8 , IRQ=10, Vector=bit7 of 0x1C0
F1: Help F3: Start Diagnose Esc: Exit

RS-485 Programming for Opt8J

If you intend to do RS-485 communication with Opt8J, please follow the RS-485 programming guide below and also refer to Chapter "**Connection Option (Opt8x) and Cable Wiring**" for more Opt8J RS-485 operation details.

The Opt8J supports **only 2-wire half-duplex RS-485 communication**. **Data+/-** pins are served for both data transmitting and receiving, depending on the RTS signal.

The port switch of each port should be set to **On** position. The port is for transmitting data if **RTS is asserted** and for receiving data if **RTS is not asserted**.

RTS scheme is suitable for any system, including Windows NT and Windows 95/98, DOS, or UNIX, that permits RTS control from application programs.

There are 2 solutions to control RS-485 2-wire transmission.

Solution 1

The following model is common in RS-485 2-wire transmission.

```
sio_SetWriteTimeouts(port, 0);   /* Set sio_write() into block mode if
                                    for Windows NT and Windows 95/98 */
sio_RTS(port, 1);                /* Turn on RTS signal. The RS-485
                                    port is ready for transmitting data. */
sio_write(port, buff, 10);       /* Write 10 byte characters in "buff".
                                    The function blocks until last
                                    character transmitted */
sio_RTS(port, 0);                /* Turn off RTS signal. The RS-485
                                    port is ready for receiving data. */
sio_read(port, buff, 10);        /* Read 10 bytes */
```

Solution 2

There is a dedicated RS-485 function in *PComm* or API-232 library. It integrates the above functions of solution 1 regarding sending data as one.

```
sio_putb_x(port, buff, tick ); /*  1. Turn on RTS and ready for
                                      transmitting data.
                                   2. Send data.
                                   3. Wait for tick time.
                                   4. Turn off RTS and ready for
                                      receiving data. */
```

For more information on these functions, please refer to *PComm* library on-line Help file for Windows NT and Windows 95/98 or API-232.txt file for DOS, respectively

.

5

Connection Option (Opt8x) and Cable Wiring

In serial data communications, the term **DTE** is for Data Terminal Equipment like PC COM1/2, serial printer and terminal. The term **DCE** is for Data Communication Equipment like modem.

RS-232 Cable Wiring for Opt8A/B/C/D/S

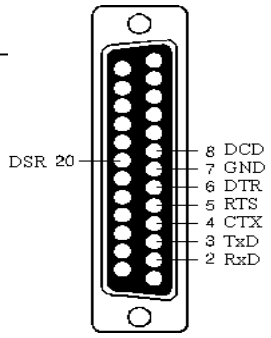
RS-232 8-port connection boxes/octopus cable designed for C168P are:

Opt8A: 8-port RS-232 DB25 female connection box
Opt8B: 8-port RS-232 DB25 male connection box
Opt8C: Octopus cable with 8 male RS-232 DB25 ports
Opt8D: Octopus cable with 8 male RS-232 DB9 ports
Opt8S: 8-port RS-232 DB25 surge protected female connection box

The followings are pin assignments for various connection options:

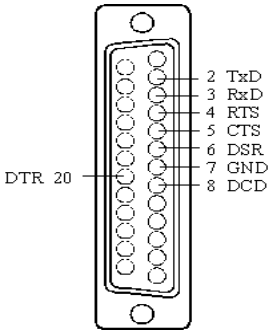
Opt8A/S
(DCE, DB25 Female)

2	RxD
3	TxD
4	CTS
5	RTS
6	DTR
7	GND
8	DCD
20	DSR



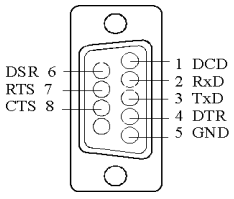
Opt8B/C
(DTE, DB25 Male)

2	TxD
3	RxD
4	RTS
5	CTS
6	DSR
7	GND
8	DCD
20	DTR

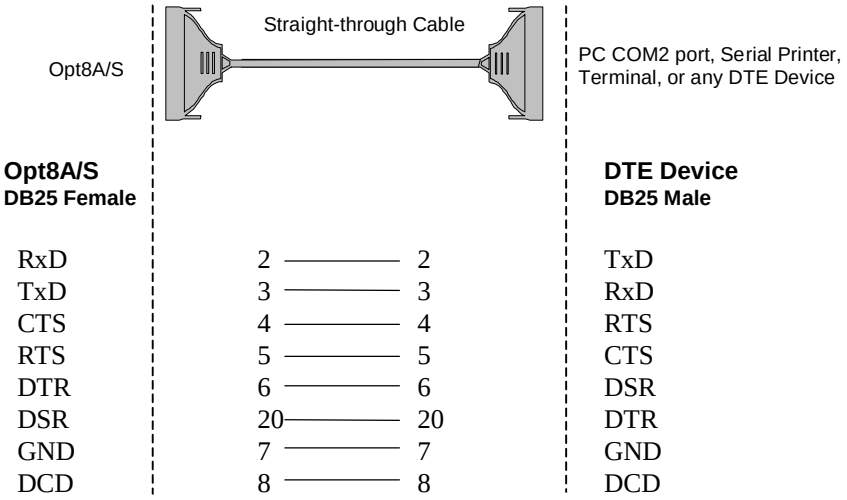


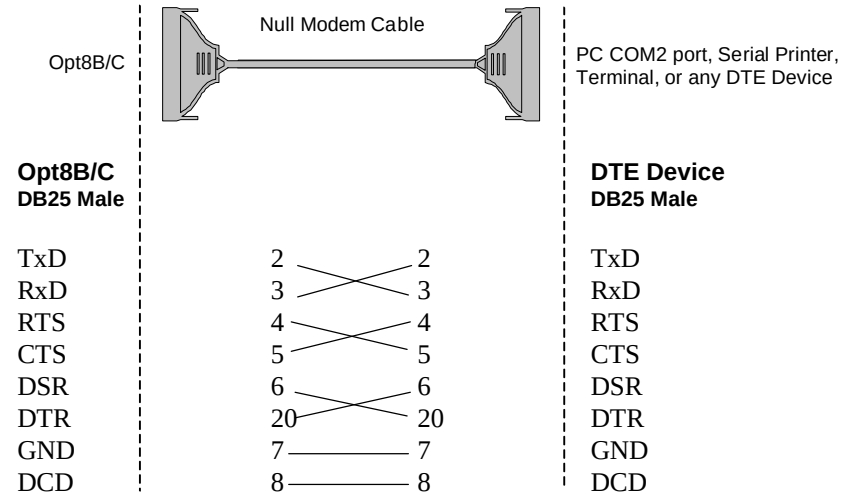
Opt8D
(DTE, DB9 Male)

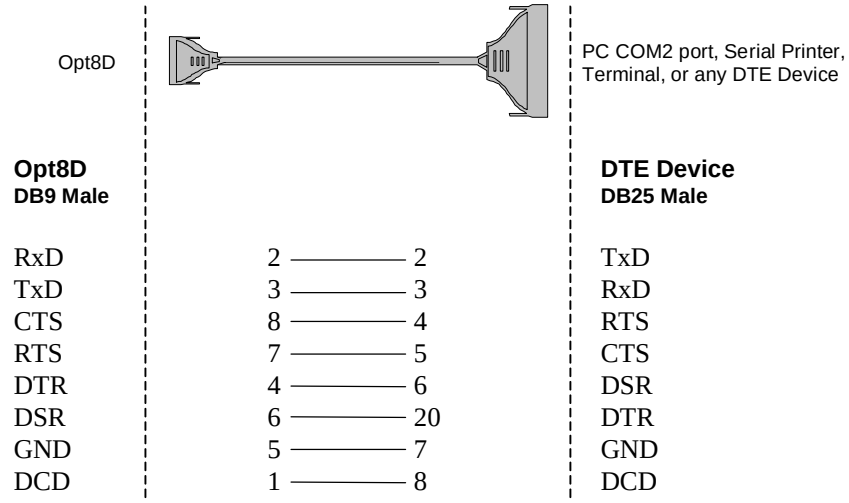
1	DCD
2	RxD
3	TxD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS



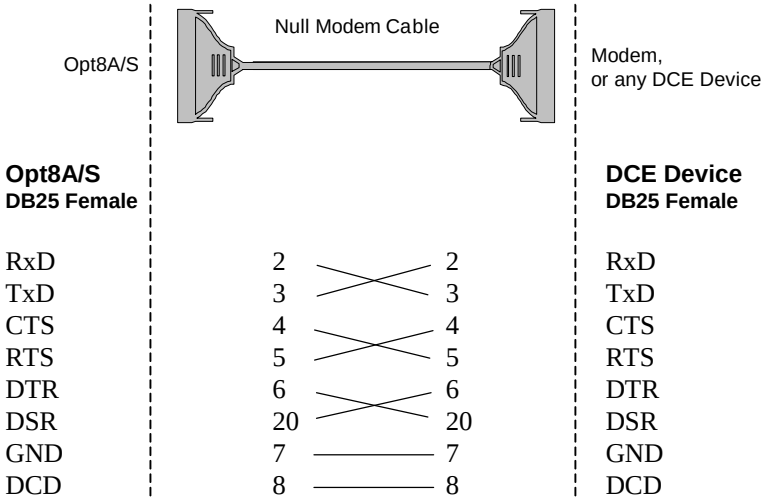
Type 1: To connect C168P to a DTE device.

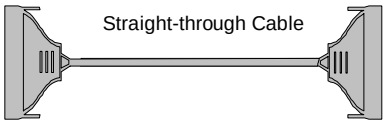






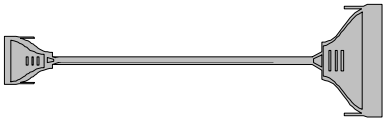
Type 2: To connect C168P to a DCE device.





Opt8B/C — Modem, or any DCE Device

Opt8B/C **DB25 Male**			**DCE Device** **DB25 Female**
TxD	2	2	RxD
RxD	3	3	TxD
RTS	4	4	CTS
CTS	5	5	RTS
DSR	6	6	DTR
DTR	20	20	DSR
GND	7	7	GND
DCD	8	8	DCD



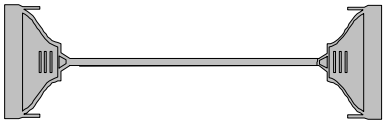
Opt8D — Modem or any DCE Device

Opt8D **DB9 Male**			**DCE Device** **DB25 Female**
RxD	2	2	RxD
TxD	3	3	TxD
CTS	8	4	CTS
RTS	7	5	RTS
DTR	4	6	DTR
DSR	6	20	DSR
GND	5	7	GND
DCD	1	8	DCD

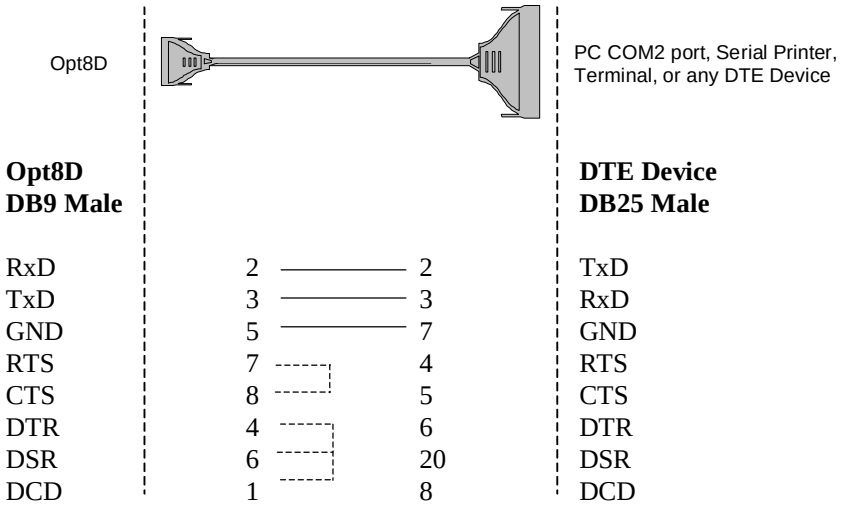
Type 3: To connect C168P to a DTE with 3-pin wiring.

If the "**Hardware flow control**" feature is set to "**ON**", you must loop back (or short) the RTS with CTS and DSR with DTR, DCD on MOXA site, indicated in dash-lines of the following diagrams. If the "**Hardware flow control**" feature is set to "**OFF**", you could just leave RTS, CTS, DSR, DTR, DCD open, ignoring the connection indicated in dash-lines.

Opt8A/S **DB25 Female**			**DTE Device** **DB25 Male**
RxD	2	2	TxD
TxD	3	3	RxD
GND	7	7	GND
RTS	5	4	RTS
CTS	4	5	CTS
DTR	20	6	DTR
DST	6	20	DSR
DCD	8	8	DCD



Opt8B/C **DB25 Male**			**DTE Device** **DB25 Male**
TxD	2	2	TxD
RxD	3	3	RxD
GND	7	7	GND
RTS	4	4	RTS
CTS	5	5	CTS
DSR	6	6	DTR
DTR	20	20	DSR
DCD	8	8	DCD



RS-422 Cable Wiring for Opt8J/F/Z

RS-422 connection boxes designed for C168P are:

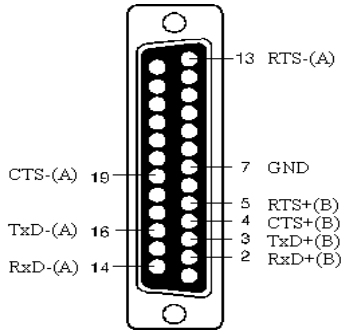
Opt8J: Connection box with 8 female RS-422/485 DB25 ports. Set the port switch to **OFF** position (RS-422) for the desired port(s).

Opt8F: Connection box with 8 female RS-422 DB25 ports and Max. 500V DC isolation protection which prevents damage caused by high potential voltage.

Opt8Z: Connection box with 8 female RS-422 DB25 ports but without isolation protection.

RS-422 Pinouts for Opt8J/F/Z:

Opt8J/F/Z		
2	RxD+(B)	
3	TxD+(B)	
14	RxD-(A)	
16	TxD-(A)	
7	GND	
4	CTS+(B)	Opt8J only
5	RTS+(B)	
13	RTS-(A)	
19	CTS-(A)	



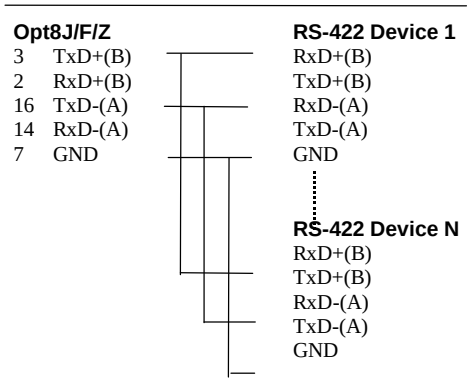
The RS-422 transmission distance can reach as long as 4000ft. The connection box needs an external power adapter to supply 5V DC power. Either 110V or 220V AC power adapter is selectable.

The followings are operation modes for RS-422:

RS-422 Point-to-point

Opt8J/F/Z			RS-422 Device
3	TxD+(B)	———	RxD+(B)
16	TxD-(A)	———	RxD-(A)
2	RxD+(B)	———	TxD+(B)
14	RxD-(A)	———	TxD-(A)
7	GND	———	GND

RS-422 Broadcasting



Opt8J RS-422 with Handshaking

Opt8J			RS-422 Device
3	TxD+(B)	———	RxD+(B)
16	TxD-(A)	———	RxD-(A)
2	RxD+(B)	———	TxD+(B)
14	RxD-(A)	———	TxD-(A)
7	GND	———	GND
5	RTS+(B)	———	CTS+(B)
13	RTS-(A)	———	CTS-(A)
4	CTS+(B)	———	RTS+(B)
19	CTS-(A)	———	RTS-(A)

RS-485 Cable Wiring for Opt8J

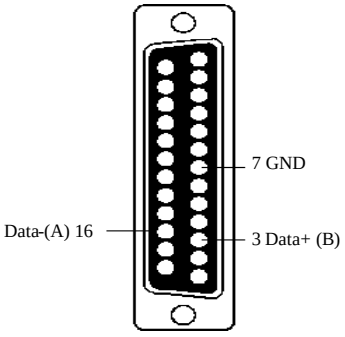
One RS-485 connection box designed for C168P is:

Opt8J: Connection box with 8 female RS-422/485 DB25 ports. Set the port switch to **ON** position (RS-485) for the desired port(s).

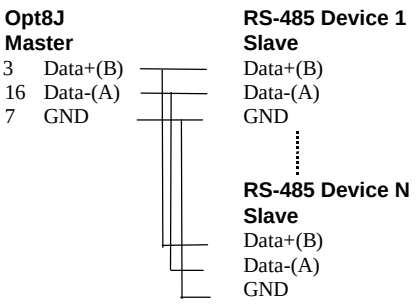
The Opt8J supports **only 2-wire half-duplex RS-485 communication**. **Data+/-** pins are served for both data transmitting and receiving, depending on the RTS signal.

RS-485 Pinouts for Opt8J:

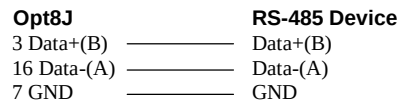
Opt8J	
3	Data+(B)
7	GND
16	Data-(A)



Multidrop RS-485 Half-duplex



Point-to-Point RS-485 Half-duplex

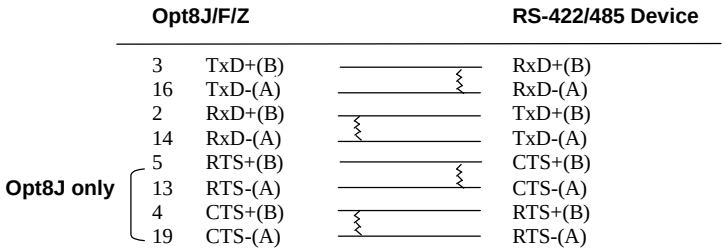


See section **"RS-485 Programming"** of Chapter **"Serial Programming Tools"** for more Opt8J RS-485 programming details.

RS-422/485 Impedance Matching

For RS-422/485 serial communications, when an electrical signal travels through two different resistance junctions in a transmission line, the impedance mismatch will sometimes cause signal reflection. Signal reflection causes signal distortion, which in turn will contribute communication errors. The solution to this problem is to establish the same impedance at the line ends as in the line itself by terminating them with resistors.

The value of the termination resistor should equal the characteristic impedance of the transmission line. The resistors should be added **near the receiving side**.



Note:

1. ≷ Stands for termination resistor near the receiving side
2. The suggested termination resistor for AWG #26 cable is 100 ohm.
3. The suggested termination resistor for phone cable is 600 ohm.

6

Troubleshooting

Common C168P problems and possible solutions are listed below. If you still have problems, contact your dealer or Moxa for help. Or use the "**Problem Report Form**" at the end of this manual to report problems to your dealer at once for faster technical support.

General Troubleshooting

1. **The MOXA driver, while installing the driver, cannot detect the MOXA board.**

   Hardware causes and solutions:

   a. The board is not installed or missing (absent). Please install it.

   b. The board is not properly plugged in the system. If that is the case, re-install the board and make sure that it fits well in a 16-bit slot this time. Sometimes the slot for plugging the board is bad. In this case, try other slots until you find a good one.

2. **The MOXA board and driver are activated but cannot transfer (transmit/receive) data.**

   Hardware Causes and Solutions:

   a. Check for wrong cable wiring. Refer to the "Connection Cable and Cable Wiring" chapter for precise pin outs of the connector type you are using.

   b. The cable or the board is defective. You may use other ports, cables or boards to verify. In addition, the *PComm* "Diagnostic" utility for Windows NT and Windows 95/98 is good for testing MOXA boards and port conditions. If Diagnostic reports error, replace the faulty components.

Software Causes and Solutions:

a. C168P checks the line status (CTS) before it sends data out if the RTS/CTS flow control feature is set to "Enable" in the configuration or application program. Please refer to the "Connection Cable and Cable Wiring" chapter for proper wiring. Check the line status of the suspected port using the diagnostic LED indicators on the mini tester.

b. Perhaps the application controlling the board is not correctly written according to the corresponding API of the operating system. To verify, please run an existing and known good application or the provided utilities by Moxa. For example, under Windows NT and Windows 95/98, *Pcomm* "Terminal emulator" or "HyperTerminal" utilities are good for testing the COM ports.

3. Why the DOS utility IQ-IRQ can not access C168P to configure?

There are several reasons that may lead to this trouble:

a. The user forgets or does not know the Configuration Access Port (CAP) of the board. See next problem **4** for how to solve this problem.
b. The CAP of the board conflicts with other add-on boards' I/O address. Please change other add-on boards' I/O address to avoid the conflict.
c. The C168P board is not plugged in a right or good slot. Please plug the board in a good 16-bit ISA slot.
d. The C168P board may malfunction. Please return for repair.

If any existing board has the same I/O address as 0x180, the **default** CAP address, or the 1st port's I/O address, you must try to avoid the conflict by doing either one the following.

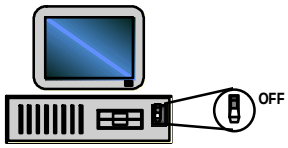
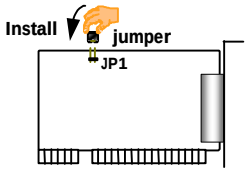
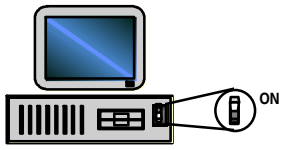
a. Install a jumper (short) at position JP1 on the upper-left corner of the board. This will force the CAP address to 0xA700.
b. Change or disable the existing board's I/O address.

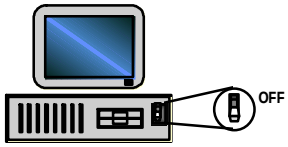
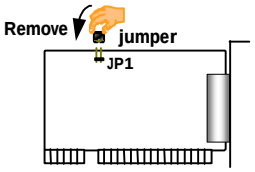
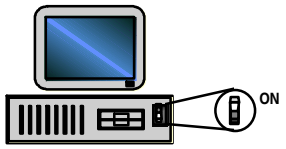
4. What to do if user forgets or does not know the Configuration Access Port (CAP) address of C168P?

The C168P multiport boards are designed without jumper or switch, so the configuration is completed only by DOS utility Io-irq.exe.

To configure the board, you need to know the board's Configuration Access Port (CAP) address. Because the CAP address is the only channel, via which the Io-irq.exe can access to the board.

The following procedure instructs user to recover once the CAP is unknown.

Step 1.	Power off the PC.	
Step 2.	Install jumper onto the JP1 of the board.	
Step 3.	Power on the PC. Now the CAP address of the board will be 0xA700.	
Step 4.	Execute Io-irq under DOS environment. A:> **Io-irq**	
Step 5.	Enter CAP address 0xA700 to access the board. *Enter the "Configuration Access Port" in HEX:* **A700**	
Step 6.	The previous hardware configuration will be shown. *Modify them if necessary. Remember the CAP address this time.*	
Step 7.	Exit the IO-IRQ.	

Step 8.	Power off the PC.	
Step 9.	Remove the jumper on position JP1.	
Step 10.	Power on the PC.	

Windows NT

This section is specific for troubleshooting under Windows NT. For general problems and solutions, please see the previous section, "General Troubleshooting".

1. **After the system reboots, the error message "Another driver in the system, which did not report its resources, has already claimed the interrupt used by xxx." appears in the Event Log.**

   This indicates that the MOXA board is found, but the IRQ is conflicting with another adapter. Please make sure there is no conflict with other adapter's IRQ. Check the BIOS IRQ settings first. Make sure that an IRQ is available.

2. **After the system reboots, the error message "Cannot find any configured MOXA Smartio/Industio Series board!" appears in the Event Log.**

a. Some partial decoded network board may interfere with our board. Please avoid from using 0x300 as I/O address for those network boards.
b. Check hardware configuration of C168P board by IO-IRQ.EXE. Then make sure the hardware configuration, including I/O addresses for each port, Interrupt Vector, IRQ, is identical to that of the driver.
c. The I/O addresses may conflict with other devices, please change another set of I/O address such as I/O:0x280, Interrupt Vector:0x2C0.
d. The board(s) is not plugged properly. Please make sure the board is seated firmly in the expansion slot.
e. The slot for plugging the board is defective.
In this case, please try other slots until you find a good one.
f. The board might be defective.

3. **The COM number of the C168P conflicts with others.**

The COM numbers of different boards happen to be the same. Try to change the COM number mappings.

4. **Windows NT system panic (blue screen).**

The possible reason is an IRQ or memory conflict with other ISA Bus adapters, like LAN and SCSI boards, or the system BIOS. Please refer to the corresponding problem in the previous section, “General Troubleshooting”, for solutions.

Windows 95/98

This section is specific for troubleshooting under Windows 95/98. For general problems and solutions, please see the previous section, “General Troubleshooting”.

1. **The system fails to find the C168P board! After system reboots, error message “Smartio C168 Series (CAP=0x0180, port 1=COM3): Board is not found” appears.**

a. Some partial decoded network board may interfere with our board. Please avoid from using 0x300 as I/O address for those network boards.
b. Check hardware configuration of C168P board by IO-IRQ.EXE. Then make sure the hardware configuration, including I/O addresses for each port, Interrupt Vector, IRQ, is identical to that of the driver.

c. The I/O addresses may conflict with other devices, please change another set of I/O address such as I/O:0x280, Interrupt Vector:0x2C0.
d. The board(s) is not plugged properly. Please make sure the board is seated firmly in the expansion slot.
e. The slot for plugging the board is defective.
In this case, please try other slots until you find a good one.
f. The board might be defective.

DOS

This section is specific for troubleshooting under DOS. For general problems and solutions, please see the previous section, "General Troubleshooting".

1. After executing SER-DRV.EXE, error message "None serial port found!" appears.

a. Make sure you're using the right driver.
b. Check if the board is properly plugged into ISA/EISA bus slot.
c. Check if the I/O address and IRQ settings in SETUP program are same as the settings on board.

Appendix

Technical Reference

Specifications

- Bus interface: ISA (EISA compatible)
- Number of ports: 8
- I/O address: 0x0000 ~ 0xFFFF
- IRQ: 2, 3, 4, 5, 7, 10, 11, 12, 15
- Data bits: 5, 6, 7, 8
- Stop bits: 1, 1.5, 2
- Parity: none, even, odd, space, mark
- UART: 8 ¡ Ñ16550 or compatible
- Speed (bps): 50 ~ 115.2K
- Connectors: 8 ¡ DB25 male or female
- Data signals: RS-232 ¡ TxD, RxD, RTS, CTS, DTR, DSR, DCD, GND
  RS-422 ¡ TxD+(B), TxD-(A), RxD+(B), RxD-(A), GND
  (Opt8J: RTS+(B), RTS-(A), CTS+(B), CTS-(A))
  RS-485 ¡ Data+(B), Data-(A), GND
- Operating temp: 0 ~ 55 ¢J
- Power requirement: 180mA max. (+5V), 110mA max. (+12V), 160mA, max. (-12V)
- Dimensions: 157mm ¡ 93mm
- Operating Systems: See the driver support list below.

	C168P
Windows NT	P
Windows 95/98	P
DOS	P
Linux	R
SCO UNIX/OpenServer	C
SCO XENIX	C
QNX	C
FreeBSD	C

P: Driver supported by Moxa and shipped with product
C : Driver supported by OS
R : Available by request
Note: Download the newest drivers from the MOXA FTP service

PC I/O Port Address Map

The following is the list of the I/O port addresses commonly used, which is good for preventing I/O address conflict when configuring C168P.

IO/ Address	Device
000-01F	DMA controller 1
020-03F	interrupt controller
040-05F	Timer
060-06F	Keyboard
070-07F	Real-time clock
080-09F	DMA page register
0A0-0BF	Interrupt controller 2
0C0-0DF	DMA controller
0F0-0FF	Math coprocessor
100-1EF	not usable
1F0-1F8	Fixed disk
200-207	Game I/O
278-27F	Parallel printer port 2 (LP2:)
2F8-2FF	Serial Port 2 (COM2:)
300-31F	Prototype card
360-36F	Reserved
378-37F	Parallel printer port 1 (LP1:)
3B0-3BF	Monochrome display
3C0-3CF	Reserved
3D0-3DF	Color graphics display
3F0-3F7	Diskette controller
3F8-3FF	Serial port 1 (COM 1:)

DB62 Connector Pinouts

The following lists the pin assignments of the **DB62** connector on the bracket.

Pin no.	Signal	Pin no.	Signal	Pin no.	Signal
1	TxD1	22	RxD1	43	CTS1
2	DTR1	23	DSR1	44	RTS1
		24	DCD1	45	GND
3	RxD2	25	TxD2	46	CTS2
4	DSR2	26	DTR2	47	RTS2
5	DCD2				
6	TxD3	27	RxD3	48	CTS3
7	DTR3	28	DSR3	49	RTS3
		29	DCD3	50	GND
8	RxD4	30	TxD4	51	CTS4
9	DSR4	31	DTR4	52	RTS4
10	DCD4	32	GND		
11	RxD5	33	TxD5	53	CTS5
12	DSR5	34	DTR5	54	RTS5
13	DCD5			55	GND
14	TxD6	35	RxD6	56	CTS6
15	DTR6	36	DSR6	57	RTS6
		37	DCD6	58	GND
16	RxD7	38	TxD7	59	CTS7
17	DSR7	39	DTR7	60	RTS7
18	DCD7	40	GND		
19	RxD8	41	TxD8	61	CTS8
20	DSR8	42	DTR8	62	RTS8
21	DCD8				

Problem Report Form
C168P

Customer name:	
Company:	
Tel:	**Fax:**
Email:	**Date:**

1. **Moxa Product**: C168P **Serial Number**: _____
2. **Moxa Driver Version**: _____
3. **Moxa hardware settings**:
   3.1 Please check the hardware configuration by IO-IRQ.EXE from DOS or Windows 95/98 DOS Prompt.

PORT	1	2	3	4	5	6	7	8
I/O								
IRQ								

   Interrupt Vector: _____
   3.2 Jumper JP1 on the board: - open - short
4. **Operating System**: - Windows 95 - Windows 98
   - Windows NT 3.51 - Windows NT 4.0
   - DOS - Others
5. **PC Host**: Make _____ Model _____
6. **CPU**: Speed _____MHz Make _____ Model _____
7. **BIOS**: Make _____ Version _____
8. **Problem Description**: Please describes the problem as clearly as possible, including the error message you see. We may have to follow your description to reproduce the problem.
   - Board not found. - Board found, but can't transfer data.
   - Can transfer data, but lose data. - Can transfer data, but with garbled data.
   - Others. Detailed error message description is recommended:

Return Procedure

For product repair, exchange or refund, you must:

- Provide evidence of original purchase.
- Fill out the Problem Report Form (PRF) as detailed as possible for shorter product repair time.
- Obtain a Return Merchandise Authorization (RMA) number from the sales representative or dealer.
- Carefully pack the product in anti-static package, and send it, pre-paid, to the dealer. The RMA number should show on the outside of the package, and include a description of the problem along with the return address and telephone number of a technical contact.